

From: Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]
To: [REDACTED]; [REDACTED]; [REDACTED]
Cc: Famocchia, Davide (JPL-392R)[Jet Propulsion Laboratory]; Johnson, Lindley (HO-DG000); Fast, Kelly E. (HO-DG000); [REDACTED]; Chesley, Steven R (JPL-392R)[Jet Propulsion Laboratory]
Subject: 2019 OK
Date: Friday, July 26, 2019 1:11:08 PM

[REDACTED], [REDACTED], [REDACTED],

There is some media interest today in 2019 OK, which passed at 0.2 LD yesterday, so I'm motivated to seek out an answer to a question I'm sure we'll be asked. Namely, why was 2019 OK not discovered by one of the major NASA surveys? Why was it not discovered until an ~11-inch telescope (SONEAR) found it at magnitude 15?

[REDACTED] pointed out earlier this week that "this object has been hanging around near opposition for several weeks, clear of the Milky Way. It's been brighter than V~21.5 for about two weeks, and brighter than V~20 for about a week. The moon was in the way for much of that time..."

So, yes, this object came in at a bad time within the lunation, but are there other reasons that all the major surveys missed discovering it? Can we just put it down to bad weather?

Bottom line: If SONEAR hadn't found this object, is it possible it could have escaped discovery completely?

Thanks,
Paul

Dr. Paul W. Chodas
Manager, Center for Near Earth Object Studies
Jet Propulsion Laboratory

[REDACTED]
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-7795 Office
[REDACTED] Cell

Gramian, Nikki N. (HQ-NN000)

From: [REDACTED] <[REDACTED]@nasa.gov>
Sent: Saturday, July 27, 2019 6:25 AM
To: Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]
Cc: [REDACTED] [REDACTED] Farnocchia, Davide (JPL-392R)[Jet Propulsion Laboratory]; Johnson, Lindley (HQ-DG000); Fast, Kelly E. (HQ-DG000); [REDACTED] Chesley, Steven R (JPL-392R)[Jet Propulsion Laboratory]; [REDACTED]
Subject: Re: [EXTERNAL] Re: 2019 OK

Hi Paul:

July 22 - high humidity all night

July 23 - heavy cirrus all night

July 24 - we didn't look in the right place.

The Moon is probably the real culprit. But the Moon is there every month, so things can sneak through. We probably would need about twice as many Pan-STARRS/CSS sized assets as we presently have to cast a good net across the sky to catch objects like this early. Weather and the Moon bot make it hard.

[REDACTED]

On Fri, Jul 26, 2019 at 8:16 PM Chodas, Paul W (US 4085) <paul.w.chodas@jpl.nasa.gov> wrote:

Hi [REDACTED]

Thank you for this very complete report.

Putting all the comments together, I'm finally seeing a clearer picture, which I'll try to summarize. This object slipped through a whole series of our capture nets, for a bunch of different reasons:

- in late June it was simply too faint for automated detection by anyone.
- In the July 7-8 timeframe it became bright enough to be detected but was still moving too slowly to be automatically identified as an NEA.
- In the July 19 timeframe it started to move fast enough to be identified as an NEA by G96 and PS1 but it was then too close to the (nearly full) Moon
- It emerged from Moon avoidance period around July 21, but CSS was already shut down because of weather.
- ATLAS did pick it up on July 21 but it was still moving too slowly to be identified as an NEA by the ATLAS filters.

So that just leaves the final few days, and I presume Pan-STARRS was just not looking in the right direction during that time?

So, was this just a particularly sneaky asteroid? I wonder how many times this situation has happened without the asteroid being discovered at all.

Thanks,

Paul

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From: paul.w.chodas@jpl.nasa.gov

Date: Friday, July 26, 2019 at 7:45 PM

To: paul.w.chodas@jpl.nasa.gov

Cc: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>, "Farnocchia, Davide (US 392R)" <davide.farnocchia@jpl.nasa.gov>, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "EXTERNAL-Fast, Kelly (US 9300-NASA)" <Kelly.E.Fast@nasa.gov>, "Chesley, Steven R (US 392R)" <steve.chesley@jpl.nasa.gov>

Subject: Re: [EXTERNAL] Re: 2019 OK

Hi Paul:

I forgot to include one additional comment on 2019 OK:

Increased exposure time would have made this easier for us to detect. We presently use 45 seconds. If we had been using 90 seconds for example, we may have found it using our normal processing. The longer exposure would lead to more movement between images, and fainter detections. But this would be at the expense of reduced sky coverage. And long sequences run higher risk from being interrupted by weather.

Our quads usually have about 18-20 footprints. They take about 70 minutes to complete. Doubling the exposure time, while maintaining the same number of footprints would take an additional 72*45 seconds, or about 55 minutes. So a "chunk" would take a little over 2 hours. That is almost twice as long as what we are presently using. And sky coverage would be cut by almost half.

On Fri, Jul 26, 2019 at 4:24 PM <img alt="Red profile icon" data-bbox="1262

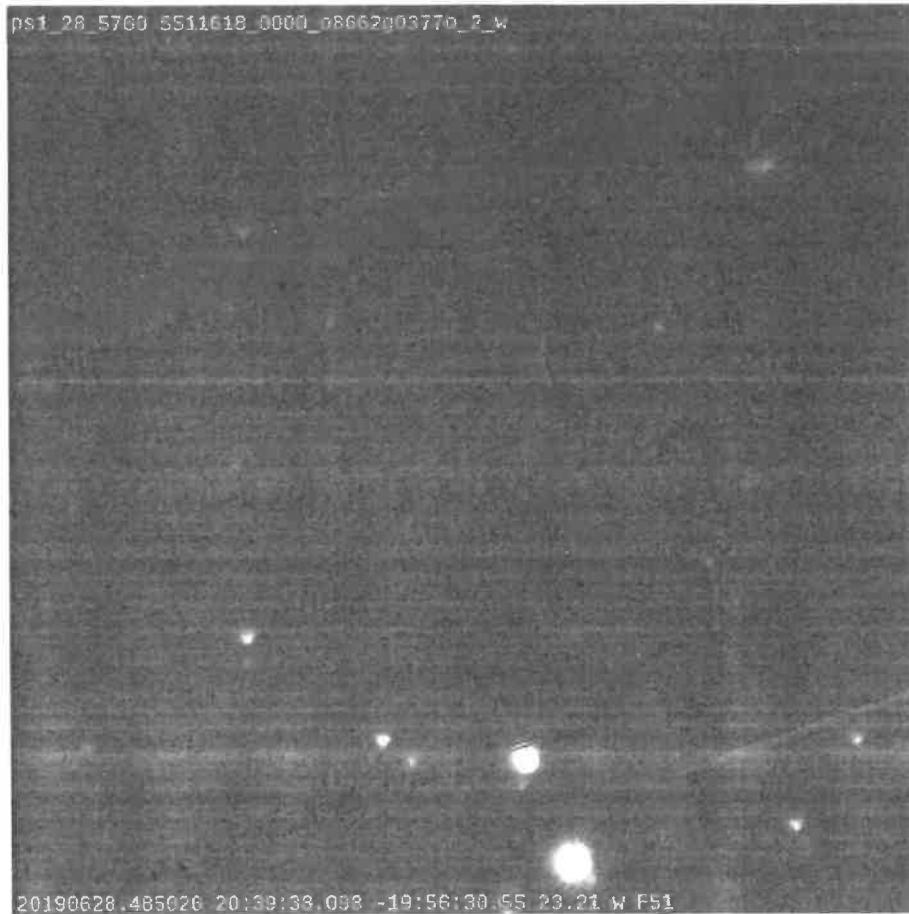
Hi Paul:

Pan-STARRS saw 2019 OK twice. Astrometry is attached.

On June 28, it was very faint. The images are attached. It is too faint for our automated source detection software to find it. If you look at the attached postage stamp images (there are 8 - the object fell in an overlap region, so was seen in two adjacent quads), you will see pattern noise which is present in our camera. Once you know where a faint object like this is in an image you can find it. But it is very difficult to find things as faint as this with the noise we have in the camera in software without triggering an intractable number of false positives. The dark streaks in the images are persistence burns caused by bright objects in the previous exposures.

I think that if we were able to upgrade our CCDs to the e2V 9k or similar CCDs in the future, then detection of faint sources like this would become possible. These CCDs have higher QE and less noise than the MITLL CCDs presently being used in the PS1 camera. Burns are not present in the PS2 camera.

On June 28, the rate of motion was 0.07 degrees per day. Digest score was 87.



20190628.485026 20:39:33.000 -19:56:30.95 23.21 W F51

ps1_28_4303_SE1161B_0000_08662003500_1_W

20190628.486963 20:39:38.153 -19:56:30.50 23.67 W F51

ps1_28_5760_SS11618_0000_05662903920_2_w



20190628.494734 20:39:38.257 -19:56:28.66 22.96 W F51

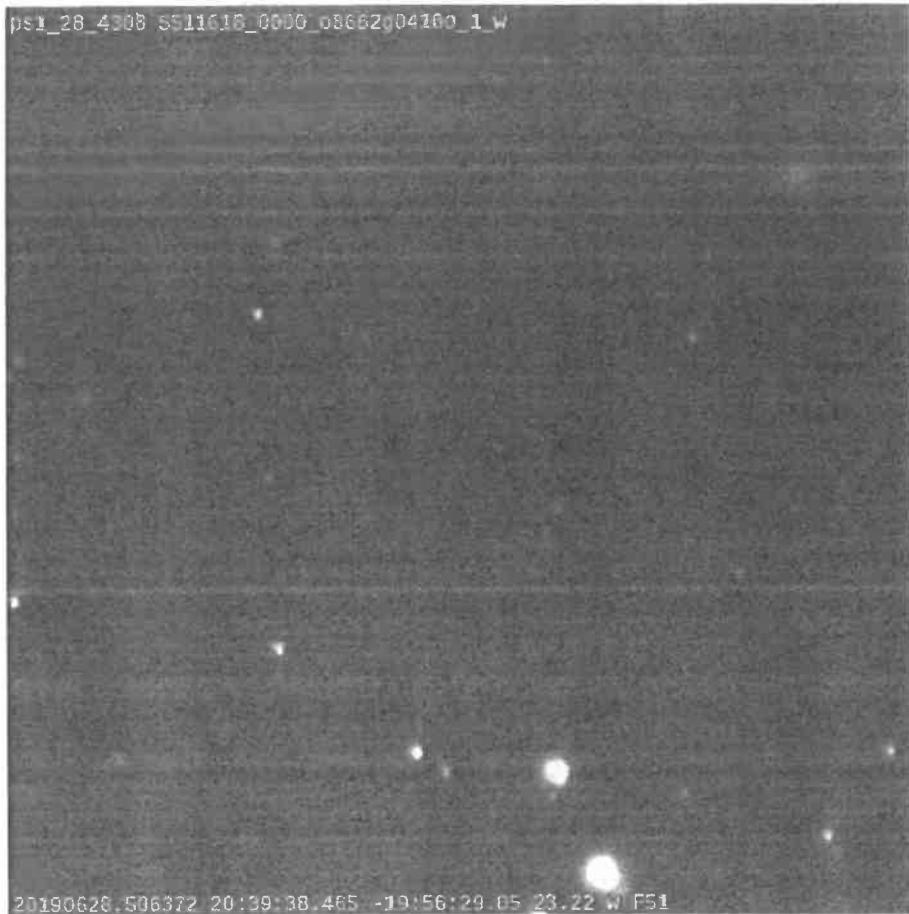
ps1_20_4300_0511618_0000_066662003950_1_W

20190628.490067 20:39:38,309 -131°56'29.60" 23.09" W F51

psi_28_5760_S511618_0000_08862904870_2_w

20100828.504436 20:39:38.463 -10:50:29.18 22.49 W F51

ps1_28_4308 ss11618_0000_08662004160_1_w

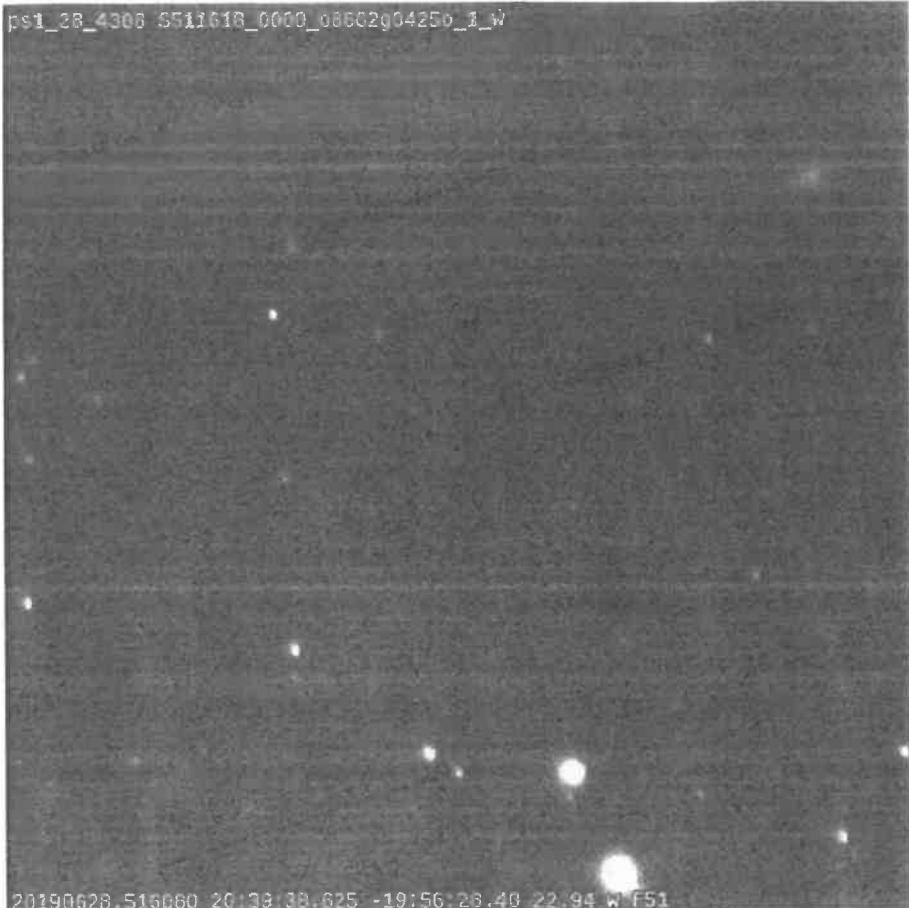


20190628.506372 20:39:38.465 -19:56:29.05 23.22 W F51

ps1_28_5760_S511616_0000_05062004220_2_W

20190628.514149 20:39:30.502 -19:56:28.31 22.66 W F51

4



20190628,516060 20:39:38.625 -19:56:26.40 22.94 W F51

On July 7, the object is brighter, but its motion was very slow, only 0.01 degrees per day. This failed our difference processing, because it was effectively self-subtracted.

Digest score was 99.

We can see the object in our warp-stack processing, but this is still in experimental mode. Warp-stack processing is done by warping an image onto a sky plane, then subtracting a (low-noise) stacked image made from many exposures. We are not yet routinely searching for NEOs in the warp-stack processing because this process still produces too many false detections - it is still experimental.

I expect that the object would have been detected via source detection techniques, which we are also experimenting with, but these are not close to production level at this time.

The (slow) motion is to the east, which is opposite to the direction that an outer solar system object would move. So in this case, there is no ambiguity - a slow moving object moving to the east at opposition is very suspicious (other than an NEO, it can also be a more distant object in a retrograde orbit such as a comet).



ps1_25_3600_5511618_0000_08671g04050_1_W

20190707.480239 20:42:50.494 -19:49:15.78 21.21 W F51

ps1_25_3680_SS11618_0000_08071904240_1_w

20190707_492639 20:42:50.525 -19°49'18.63" 21.73" W F51



20190707_B05051 20:42:50.547 -19°49'13.21" 21.49" W F51

In the subsequent period, the moon became bright. And the object's motion may have entered a period during which the digest score became low (see the Micheli, Wainscoat, Denneau paper). The object was very close to the Moon on July 18. It was in our Moon avoidance zone roughly from July 14-21. We had some weather issues in the second half of the night on July 11 and 12.

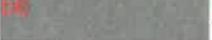
I hope this is helpful.

Aloha,

96

K19000K	C2019	06	28.48696320	39	38.147-19	56	30.33	22.9	GVE0056F51
K19000K	C2019	06	28.49473420	39	38.257-19	56	29.69	22.7	GVE0056F51
K19000K	C2019	06	28.49666720	39	38.312-19	56	29.55	22.7	GVE0056F51
K19000K	C2019	06	28.50443620	39	38.462-19	56	29.22	22.2	GVE0056F51
K19000K	C2019	06	28.50637220	39	38.464-19	56	29.05	22.9	GVE0056F51

K19000K	C2019	06	28.51608020	39	38.628-19	56	28.52	22.6	GVE0056F51
K19000K	C2019	07	07.46783920	42	50.466-19	49	13.96	21.2	GVE0056F51
K19000K	C2019	07	07.48023920	42	50.498-19	49	13.85	21.2	GVE0056F51
K19000K	C2019	07	07.49263920	42	50.520-19	49	13.54	21.2	GVE0056F51
K19000K	C2019	07	07.50505120	42	50.547-19	49	13.23	21.3	GVE0056F51

On Fri, Jul 26, 2019 at 10:36 AM  <@.edu> wrote:

Hi Paul,

Removing the moon and bad weather, this object would have become visible to G96 starting around July 8, but too slow to detect until about July 19 (on July 8 it was moving slower than TNO rates at transit!). It would have been visible to 703 starting July 15, but too slow to detect until July 22, a few days before flyby.

I can't recall any similar cases where an NEO was bright enough for easy detection, but too slow to detect for most of its apparition.





Sky Survey

The University of Arizona

Lunar and Planetary Laboratory

On Jul 26, 2019, at 12:05 PM, Chodas, Paul W (US 4085) <paul.w.chodas@jpl.nasa.gov> wrote:

Good point, [REDACTED] but I suspect that background like this will only partially alleviate concerns that a relatively large one was "missed".

Question: if it weren't for bad weather and lunar interference, would this one have slipped past the CSS filters as well?

Thanks,

Paul

Dr. Paul W. Chodas

Manager, Center for Near Earth Object Studies

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From: [REDACTED] [REDACTED] [.edu](mailto:[REDACTED]@jpl.nasa.gov)

Date: Friday, July 26, 2019 at 11:57 AM

To: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>

Cc: [REDACTED] [REDACTED] [.edu](mailto:[REDACTED]@jpl.nasa.gov), "Farnocchia, Davide (US 392R)"

<davide.farnocchia@jpl.nasa.gov>, [REDACTED] [REDACTED] [.edu](mailto:[REDACTED]@jpl.nasa.gov), "Johnson, Lindley (HQ-DG000)" <Lindley.johnson@nasa.gov>, "EXTERNAL-Fast, Kelly (US 9300-NASA)" <Kelly.E.Fast@nasa.gov>, [REDACTED] [REDACTED] [.edu](mailto:[REDACTED]@jpl.nasa.gov), "Chesley, Steven R (US 392R)" <steve.chesley@jpl.nasa.gov>

Subject: Re: [EXTERNAL] Re: 2019 OK

Hi Paul,

It may also be worth mentioning the slew of other earth-approaching (~lunar distance) objects that were detected by NASA-funded surveys in the last few weeks, to put this single “miss” in context.

[REDACTED]

[REDACTED]

[REDACTED] Sky Survey

The University of Arizona

Lunar and Planetary Laboratory

On Jul 26, 2019, at 11:54 AM, Chodas, Paul W (US 4085)
paul.w.chodas@jpl.nasa.gov wrote:

Thanks, [REDACTED] So, if I get asked about this, I would pass along your sentiment, that this case proved useful for refining operating boundaries at NASA surveys so that NEAs like this one can be identified earlier.

In this case, ATLAS could have given an “alert” 3 days earlier than we actually got, which is obviously very significant.

Paul

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Manager, Center for Near Earth Object Studies

Jet Propulsion Laboratory

[REDACTED]

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Hi Paul,

That sounds about right. It's not a very satisfying answer because we know we can do better. But these cases help us push our operating boundaries even wider so that there will be fewer of these in the future.

On Fri, Jul 26, 2019 at 8:14 AM Chodas, Paul W (US 4085) <paul.w.chodas@jpl.nasa.gov> wrote:

Thanks, [redacted] So, in contrast to the Chelyabinsk line of “it came in too close to the Sun to be observed”, we have here a converse situation:

"It came in from too close to the opposition point [to be identified quickly as an NEO]".

This was a sneaky one on many fronts (full moon, monsoon season, high v. infinity, very near the opposition point).

Paul

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Manager, Center for Near Earth Object Studies

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From: reddacted@edu

Date: Friday, July 26, 2019 at 10:49 AM

To: "Farnocchia, Davide (US 392R)" <davide.farnocchia@jpl.nasa.gov>

Cc: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>

[<reddacted@edu>](mailto:reddacted@edu) <reddacted@edu>,

"Johnson, Lindley (HQ-DG000)" <Lindley.johnson@nasa.gov>,

"EXTERNAL-Fast, Kelly (US 9300-NASA)" <Kelly.E.Fast@nasa.gov>,

[<reddacted@edu>](mailto:reddacted@edu), "Chesley, Steven R (US 392R)"

<steve.chesley@jpl.nasa.gov>

Subject: Re: [EXTERNAL] Re: 2019 OK

Hi reddacted

A10f1QW had digest2 = 97. Using high digest2 as an acceptance criterion doesn't help too much because nearly everything unknown and moving slowly will already have a high digest2. The main consideration for us in this case is separation of slow-moving NEOs from slightly jittering variable stars, which all go into the "unknown, slow-moving, might-be-an-NEO" pool. Our pixels are big so at our cadence we have more confusion in this regime than PS1 or G96.

On Fri, Jul 26, 2019 at 7:30 AM Farnocchia, Davide (US 392R)
<davide.farnocchia@jpl.nasa.gov> wrote:

[REDACTED]

Just curious, what is the digest score for that tracklet?

If higher than 65, would it make sense to directly use the digest score for your screening cuts?

[REDACTED]

Sent from my iPhone

On Jul 26, 2019, at 7:19 PM, [REDACTED] <[\[REDACTED\].edu](mailto:[REDACTED].edu)> wrote:

Hi Paul,

We have had some weather, but it's not to blame. ATLAS observed it as part of routine operations on July 21 -- we even had an automatic tracklet for it -- but as is typical of these close approachers, it was moving very slowly against the background and the tracklet just missed our screening cuts. Once it hit the NEOCP it was an easy find.

We have since opened up our minimum velocity cut a bit, from 0.1 deg/day to 0.025 deg/day, which should match our sensitivity better.

[REDACTED]

On Fri, Jul 26, 2019 at 7:10 AM Chodas, Paul W (US 4085)
<paul.w.chodas@jpl.nasa.gov> wrote:

[REDACTED]

There is some media interest today in 2019 OK, which passed at 0.2 LD yesterday, so I'm motivated to seek out an answer to a question I'm sure we'll be asked. Namely, why was 2019 OK not discovered by one of the major NASA surveys? Why was it not discovered until an ~11-inch telescope (SONEAR) found it at magnitude 15?

_____ pointed out earlier this week that "this object has been hanging around near opposition for several weeks, clear of the Milky Way. It's been brighter than V~21.5 for about two weeks, and brighter than V~20 for about a week. The moon was in the way for much of that time..."

So, yes, this object came in at a bad time within the lunation, but are there other reasons that all the major surveys missed discovering it? Can we just put it down to bad weather?

Bottom line: If SONEAR hadn't found this object, is it possible it could have escaped discovery completely?

Thanks,

Dr. Paul W. Chodas

Manager, Center for Near Earth Object Studies

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From: [REDACTED] [NATIONAL INSTITUTE OF AEROSPACE](#)
To: [Johnson, Lindley \(HO-DG000\)](#); [Fast, Kelly E. \(HO-DG000\)](#)
Subject: [EXTERNAL] about 2019 OK
Date: Monday, July 29, 2019 12:29:17 PM

Okay, I've been following the email thread about this story, am happy to reach out to reporters about where to go for accurate info -- Liam Mannix, Sydney Morning Herald, Allyson Chiu, WaPo, etc. I'm going to ask Tim to help me get my facts straight.

Pretty much all of what I've seen is a plain old repetition of the Sydney Morning Herald story of last week, including the latest, regurgitated in the Epoch Times, a dubious news source based in NYC, founded and run by Chinese Falun Gong followers and strongly right-leaning and rabidly anti-Communist-China.

And we're obviously talking here about a broader long-term communication strategy for planetary defense -- and I'm not sure that OCOMMS will back us up. What do you think? The astrobiology team's interactions with Grey Hautaloma thus far have not been good. What is your take on this guy? We're really gonna miss Dwayne.... And then there's the whole "Moon 2024" thing....

[REDACTED], Ph.D.
Consultant to NASA's Astrobiology Program and Planetary Defense Coordination Office
National Institute of Aerospace
ph. [REDACTED] [REDACTED] (mobile)



From: Andrews, Victoria Pidgeon (HQ-CQ000)
To: Johnson, Lindley (HQ-DG000); Fast, Kelly E. (HQ-DG000); Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]
Subject: RE: [EXTERNAL] Re: Unhappy about Washington Post story
Date: Monday, July 29, 2019 9:19:28 AM

Thanks for including me in this thread... Do we need talking points on the discovery history and 'why it got so close' before detection?

From: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>
Sent: Sunday, July 28, 2019 9:14 AM
To: RE: [EXTERNAL] Re: Unhappy about Washington Post story Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>
Cc: RE: [EXTERNAL] Re: Unhappy about Washington Post story (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE] <RE: [EXTERNAL] Re: Unhappy about Washington Post story>
Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory] <paul.w.chodas@jpl.nasa.gov>; Johnson, Alana R. (HQ-NG000)[InuTeq, LLC] <alana.r.johnson@nasa.gov>; Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

BTW, all, just for context, it appears that 2019 OK is by far the largest asteroid to pass this close to Earth in the last century!

Nothing this big is predicted to pass this close again until Apophis on 2029.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: RE: [EXTERNAL] Re: Unhappy about Washington Post story <RE: [EXTERNAL] Re: Unhappy about Washington Post story>
Date: Sat, July 27, 2019 1:44 PM -0400
To: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
CC: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, RE: [EXTERNAL] Re: Unhappy about Washington Post story (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE] <RE: [EXTERNAL] Re: Unhappy about Washington Post story>, "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

Hi Kelly, not dragging out. This one is necessary IMO.

The ASASSN guys have a long history with the MPC. RE: [EXTERNAL] Re: Unhappy about Washington Post story and I had to chew them out (in an MPEC no less) in their previous iteration for announcing--via the Astronomer's Telegram--an object for which they predicted a chelyabinsk-type impact. They were wrong. Their astrometry was really bad and when confirmed the object was .2 AU away or something. So it is no surprise they ignored NASA and the MPC. At least not to me.

The full details on this object are scant. I can't tell who actually found it--I think I'll have to go to RE: [EXTERNAL] Re: Unhappy about Washington Post story. The discovery is currently SONEAR, who is applying for IAWN membership. But

ASASSN folks apparently used two scopes at existing big telescope locations in the US but didn't use the right observatory codes. Ugh.

I know one of the goals of IAWN is to be the source for information. How do we do that when the press interviews random astronomer--or worse, Voldemort (let's not forget he was interviewed about NEOs on CNN...)?



On Sat, Jul 27, 2019 at 1:06 PM Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov> wrote:

So here's Popular Science, also not asking NASA or CNEOS, rattling off numbers without sources (and quotes from [REDACTED] and [REDACTED] from other interviews):

<https://www.popsci.com/asteroid-close-earth-ok-2019/>

Sorry to drag out the conversation, but as I wonder why the media talk to the first person they find instead of NASA...

They do quote [REDACTED] who spoke with Public Radio International and who observed 2019 OK with the All-Sky Automated Survey for Supernovae (ASASSN). I don't see that ASASSN submitted 2019 OK observations to MPC, or even has an observatory code. Looking at their page <http://www.astronomy.ohio-state.edu/~assassin/index.shtml> their telescopes are hosted on LCO sites, but LCO isn't listed as observing 2019 OK either. [REDACTED], does ASASSN submit to MPC and I missed it? They fancy themselves a "Small Synoptic Survey Telescope" complementing LSST by surveying shallow and often, sort of a supernova version of ATLAS, but they survey only to 18th magnitude (with quads of 14cm telescopes).

But if they're speaking on the radio about observing NEOs with their survey, they should either get more background or refer to NASA. At least the [REDACTED] did say that \$1B/yr should go to NEO work, ha! I gave a PD talk at [REDACTED] a few years ago when [REDACTED] was a [REDACTED] undergrad there, but it was in the School of Earth Sciences, not the Astronomy Dept.

Kelly

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
Planetary Defense Coordination Office
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: [REDACTED] <[REDACTED]>

Date: Saturday, July 27, 2019 at 10:26 AM
To: Lindley Johnson <lindley.johnson@nasa.gov>
Cc: " [REDACTED] (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE]" [REDACTED] >, Kelly Fast <kelly.e.fast@nasa.gov>, "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

AMEN to that... let's not forget they have periodically had good advocates and even programs, and shut them down...

On Sat, Jul 27, 2019 at 10:11 AM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

What makes this especially galling is that the Australian are doing essentially nothing to support Planetary Defense.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: [REDACTED] >
Date: Sat, July 27, 2019 9:55 AM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
CC: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>, "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "EXTERNAL" [REDACTED] <alana.r.johnson@nasa.gov>
Subject: [EXTERNAL] Re: Unhappy about Washington Post story

See attached story from the Sydney (Australia) Morning Herald - perhaps where this thing started, media-wise? It quotes the two Australian astronomers - anybody know them? If so, it might be helpful to ask them to think before they speak (of nuclear explosions and such...). I don't know whether the Sydney reporter reached out to them or whether they reached out to him. All the rest - including WaPo -- is simply repetition.

What this story says to me is that the detection and notification system worked perfectly, as usual. (For pete's sake, these stories used CNEOS's visuals!) If Alana reaches out, she might want to make this point.

This story also says to me that we have to keep up our good work of calming down asteroid rhetoric - city-killers, nukes, etc. I will reach out as well.

Paul, when you talk with NPR (is it Joe Palca?), I'm sure you'll make these points -- the system keeps working like it's supposed to, an asteroid can't be a "city killer" when it flies by Earth at 70,000 km, and if and when an asteroid impact might occur, it would not release any nuclear radiation. (Tim, no wonder you went ballistic when you saw this....)

Sigh...

Cheers,

b6
b7c

b6 b7c D.
Consultant to NASA's Astrobiology Program and Planetary Defense Coordination Office
National Institute of Aerospace
ph. b6 b7c (mobile)
b6 b7c

On Fri, Jul 26, 2019 at 10:48 PM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

As Kelly says, I think this is lazy journalism.

I dont recognize the name of the reporter. Not one of the usual WP science reporters.

I've copied Alana. Maybe NASA OCOMMS can suggest to WP "WTF, over".

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Fri, July 26, 2019 9:11 PM -0400
To: "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>

CC: "EXTERNAL" b6 b7c b8c
b9 b10 (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE]"

Subject: Re: Unhappy about Washington Post story

Hi Paul,

I hadn't seen this one, but I saw these names in earlier articles elsewhere, so I think it's just the usual lazy journalism where reporters report on and follow up other reporter's reports. That's why the Washington Post is focusing on Australian scientists... they saw them in another article and didn't think about the fact that they're in Washington DC, and that NASA HQ is in Washington DC, hmmm....

Adding Linda here because she's great at being a third party and reminding reporters that it IS possible to reach directly out to NASA if they want the right information on what NASA is doing.

At least NPR reached out to you instead of Australia!

Have a nice weekend,
Kelly

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Date: Friday, July 26, 2019 at 8:55 PM
To: Lindley Johnson <lindley.johnson@nasa.gov>, Kelly Fast
<kelly.e.fast@nasa.gov>
Cc: 
Subject: Unhappy about Washington Post story

Lindley and Kelly,

As you probably already know, this article in the Washington Post is getting major coverage:

https://www.washingtonpost.com/nation/2019/07/26/it-snuck-up-us-city-killer-asteroid-just-missed-earth-scientists-almost-didnt-detect-it-time/?utm_term=.2a6a298e3707

I find it disheartening that the scientists quoted therein have very little do to with asteroids, and yet the article makes them out as playing a major role in the story and seems to focus on how they felt and what they think needs to be done. They do provide lip service to "NASA" and provide links, but very few will follow those. Why on Earth wouldn't the reporter seek out comments from true experts like you guys at PDCO or observers at e.g. ATLAS, or maybe us at CNEOS whose web site the scientist clearly used?

OK, I'm just venting to you guys, but it is frustrating. Somehow NASA is not seen as the automatic go-to source for questions in stories like this.

By the way NPR contacted me, and I spoke with them this morning. I'll be interviewed

on Monday, but interest in this story will be negligible by then.

Have a great weekend!

Paul

Dr. Paul W. Chodas
Manager, Center for Near Earth Object Studies
Jet Propulsion Laboratory
301-121
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-7795 Office
[REDACTED] Cell

From: [REDACTED] NATIONAL INSTITUTE OF AEROSPACE]
To: Johnson, Lindley (HQ-DG000)
Cc: East, Kelly E. (HQ-DG000); Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]; Johnson, Alana R. (HQ-DG000)[InuTeq, LLC]; EXTERNAL [REDACTED] [REDACTED] b6
Subject: [EXTERNAL] Re: Unhappy about Washington Post story
Date: Saturday, July 27, 2019 9:55:01 AM
Attachments: [City-killer Asteroid 2019 OK almost hits Earth.pdf](#)

See attached story from the Sydney (Australia) Morning Herald - perhaps where this thing started, media-wise? It quotes the two Australian astronomers - anybody know them? If so, it might be helpful to ask them to think before they speak (of nuclear explosions and such...). I don't know whether the Sydney reporter reached out to them or whether they reached out to him. All the rest - including WaPo -- is simply repetition.

What this story says to me is that the detection and notification system worked perfectly, as usual. (For pete's sake, these stories used CNEOS's visuals!) If Alana reaches out, she might want to make this point.

This story also says to me that we have to keep up our good work of calming down asteroid rhetoric - city-killers, nukes, etc. I will reach out as well.

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[REDACTED] b6, Ph.D.
Consultant to NASA's Astrobiology Program and Planetary Defense Coordination Office
National Institute of Aerospace
ph. [REDACTED] [REDACTED] b6 (mobile)
[REDACTED] b6

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<lindley.johnson@nasa.gov>
CC: "EXTERNAL [REDACTED] ([REDACTED] [REDACTED] [REDACTED])", " [REDACTED]
[REDACTED] (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE]"
[REDACTED] >
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Dr. Paul W. Chodas

Manager, Center for Near Earth Object Studies

Jet Propulsion Laboratory



4800 Oak Grove Drive

Pasadena, CA 91109-8099

(818) 354-7795 Office



Cell

The Sydney Morning Herald

EXCLUSIVE NATIONAL SPACE

The day Earth had a near-miss with a 'city-killer' asteroid

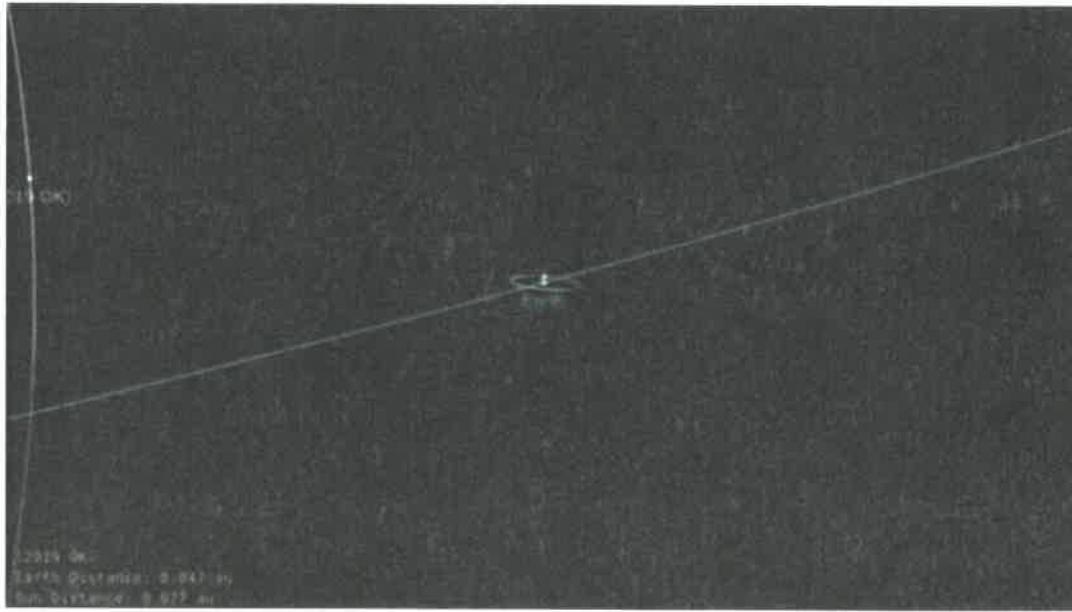
By Liam Mannix

July 25, 2019 – 2.59pm



An asteroid about 100 metres in diameter and racing at 24 kilometres a second has just missed the Earth.

The rock, called Asteroid 2019 OK, sped by our planet at 11.22am on Thursday, passing within about 70,000 kilometres – which is a long way away but closer to us than the moon's orbit.



The asteroid passed close by on Thursday morning. [NASA](#)

Due to the trajectory of the asteroid – flying towards us from the direction of the sun – astronomers had no warning it was headed our way.

It is the largest rock to fly at such close quarters to the Earth this year, and possibly for many years.

Astronomers believe the asteroid is between 57 and 130 metres in diameter.

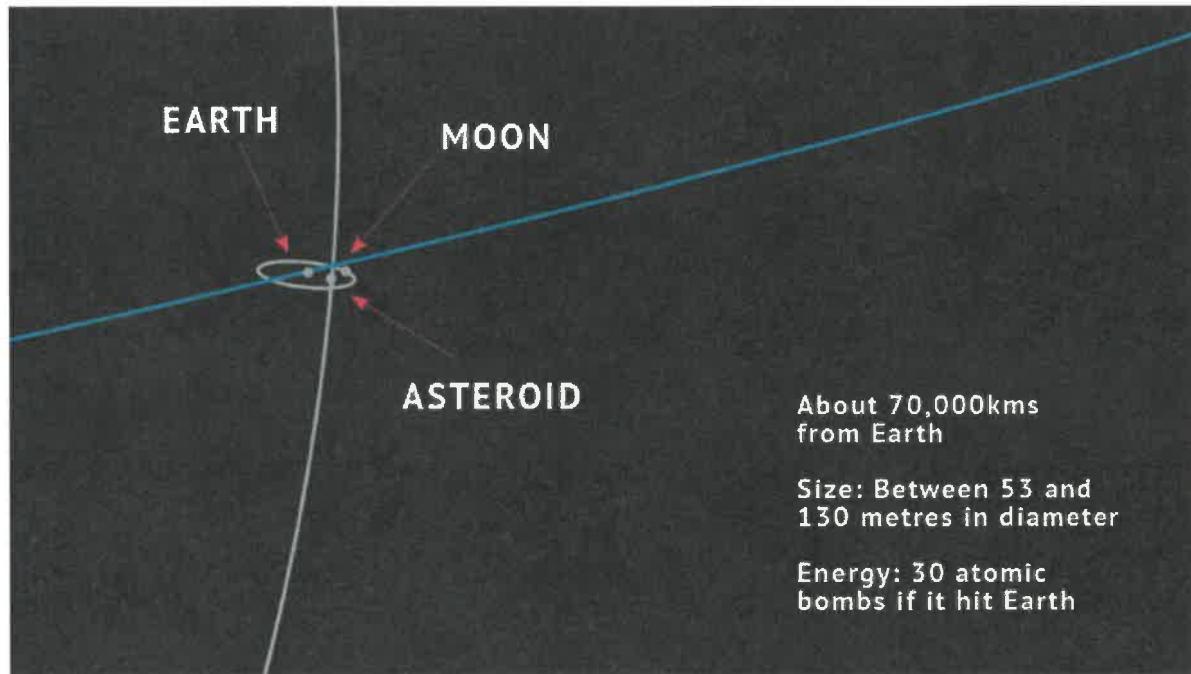
Telescopes only began to pick it up a couple of days ago, with a confirmation it was an asteroid only coming in the past 24 hours.

"It's impressively close. I don't think it's quite sunk in yet. It's a pretty big deal," says Associate Professor Michael Brown, from Monash University's school of physics and astronomy.

"[If it hit Earth] it makes the bang of a very large nuclear weapon – a very large one."

How big?

"It would have hit with over 30 times the energy of the atomic blast at Hiroshima," says Swinburne University astronomer Associate Professor Alan Duffy.



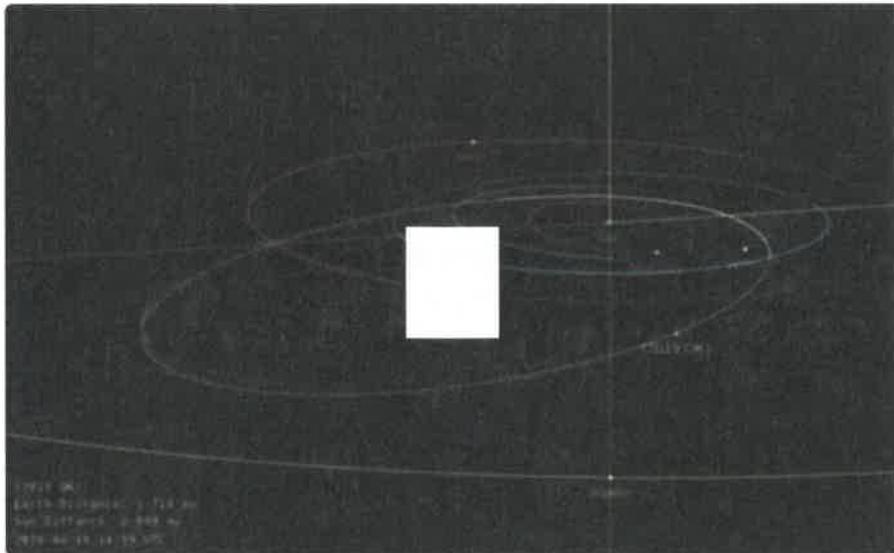
"It's a city-killer asteroid. But because it's so small, it's incredibly hard to see until right at the last minute."

"It's threading tightly between the lunar orbit. Definitely too close for comfort."



ASAS-SN
@SuperASASSN

This is the video of the close encounter of Asteroid 2019 OK
we have been Twitting all day with the Earth:
watchers.news/2019/07/24/ast...



3,517 8:45 PM - Jul 24, 2019

2,243 people are talking about this



YE Quanzhi @Yeqzids - Jul 24, 2019

Replies to @Yeqzids

Now we have pre-discovery observations from @PS1NEOWatch back to June 28. This rock (quite big; close to 100-m in size) will pass us at ~70,000 km in about 4 hrs, at which point it will brighten to V=9. Such bright fly-by isn't often -- once per a few years if my memory serves.



YE Quanzhi

@Yeqzids

Just in case you wonder: this asteroid poses NO IMMEDIATE THREAT to us. It will pass safely by the Earth.

14 5:42 PM - Jul 24, 2019

[See YE Quanzhi's other Tweets](#)

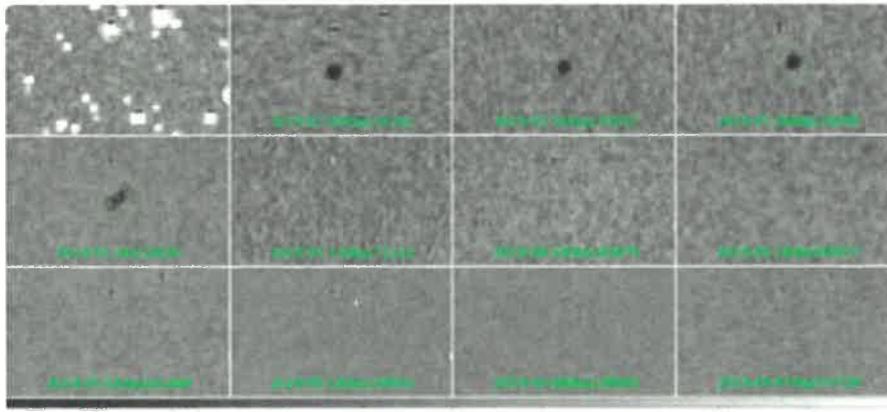
Asteroids this size tend to pass by once every decade.

Three other asteroids also raced past the Earth on Thursday, but none were as close or as large as 2019 OK. Because it was only just spotted, its existence has not yet been widely reported.

The asteroid was picked up by separate astronomy teams based in Brazil and the US over the past few days.



Possible bright (g~14 mag) Near Earth Object discovered, if confirmed, it will be our first NEO! Now trying to learn what to do with the data to properly submit the info :)



48 1:57 PM - Jul 24, 2019

18 people are talking about this

NASA's Jet Propulsion Laboratory confirmed the discovery. The asteroid passed Earth just 73,000 kilometres away, and was sized between 57 and 130 metres in diameter, according to the lab's data.

"This is one of the closest approaches to Earth by an asteroid that we know of. And it's a pretty large one," says Professor Brown.

By comparison, the rock that killed the dinosaurs was about 16 kilometres across, said Professor Gretchen Benedix, a planetary science researcher at Curtin University.

"It's not totally out to lunch, these things happen. It's more rare they happen within a lunar distance," she said.

"If that were to hit the Earth, that would be bad. Something 100 metres across would leave a noticeable hole on the planet."

The Chelyabinsk meteor, which exploded over Russia in 2013, was only about 20 metres in diameter.

Astronomers typically try to pick up asteroids long before they pass by Earth.

But this one was particularly difficult to see because it was coming toward the Earth from the direction of the sun, Professor Brown said.

"It was faint, it was close to the sun. It's been getting closer to us, getting brighter and brighter, and finally some smaller telescopes have picked it up. Literally, right about now, it's about 70,000 kilometres from Earth," he said.

A person armed with a pair of binoculars and looking at the right spot in the night sky may even have been able to spot it, he said.

Several dozen smaller asteroids in the six-to-12 metre range fly past Earth at a distance closer than the moon every year, according to NASA.

But such a large rock passing so close is unusual.

"These events are rare. But we know, sooner or later, there's going to be one with our name on it," says Professor Duffy.

Australian National University astronomer Dr Brad Tucker said it may be that many rocks of similar size whizz by close to the Earth – we just don't detect them.



Liam Mannix



Liam is The Age and Sydney Morning Herald's science reporter

From: [REDACTED]
To: [REDACTED]
Cc: [REDACTED]; Johnson, Lindley (HO-DG000); [REDACTED]
Subject: [EXTERNAL] Re: Who discovered 2019 OK
Date: Sunday, July 28, 2019 12:05:26 PM

Happy to help, [REDACTED] !

On Sun, Jul 28, 2019 at 11:49 AM [REDACTED] > wrote:

Ok, thanks [REDACTED] and [REDACTED] I do think getting them their own code would help separate their stuff appropriately. That is of course personal opinion on my part, but I like to think of the codes as programs, and I know that isn't always the prevailing opinion.

thanks for responding so quickly on a Sunday!! Not necessary :)

[REDACTED]

On Sun, Jul 28, 2019 at 11:48 AM [REDACTED] > wrote:

They just used whatever was "nearby". We should probably change them to something more "neutral".

711 is fine, F65 is not.

On Sun, Jul 28, 2019 at 3:41 PM [REDACTED] > wrote:

Hi [REDACTED], thanks. Did the ASAS-SN guys use the right observatory codes? It looked to me like they just bolted on to whatever code was near their telescope?

This is super helpful information... I love that we have the exact timestamps etc.

talk soon

[REDACTED]

On Sun, Jul 28, 2019 at 11:32 AM [REDACTED] > wrote:

Hi [REDACTED],

I am cc'ing [REDACTED] because he and I prepared the MPEC, with a remote orbit assist from [REDACTED]. Here's my understanding.

The first observations from SONEAR arrived at 2019-07-24T12:53:18, as S511618. The first observations from ASAS-SN arrived at 2019-07-24T17:40:53, as asassn3. They were independent but later.

All other observations, including those taken before those from SONEAR and ASAS-SN, were reported subsequently and in response to the NEOCP listing and scout alerts.

Thanks,

On Sun, Jul 28, 2019 at 10:26 AM [REDACTED] > wrote:
Hi [REDACTED], cc to lots of other folks:

Who found 2019 OK? What's the story as it seems unclear right now?

[REDACTED]
[REDACTED], PhD
[REDACTED]
[REDACTED] Minor Planet Center
Center for Astrophysics, Harvard & Smithsonian
60 Garden Street, [REDACTED]
Cambridge, MA 02138
[REDACTED]

[REDACTED]
[REDACTED], PhD
[REDACTED], Minor Planet Center

[REDACTED]
[REDACTED], PhD
[REDACTED]
[REDACTED] Minor Planet Center
Center for Astrophysics, Harvard & Smithsonian
60 Garden Street, [REDACTED]
Cambridge, MA 02138
[REDACTED]

From: Andrews, Victoria Pidgeon (HQ-CQ000)
To: Fast, Kelly E. (HQ-DG000); Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]; Johnson, Lindley (HQ-DG000)
Cc: Hautaluoma, Grey (HQ-NI000)
Subject: RE: [EXTERNAL] Re: Unhappy about Washington Post story
Date: Monday, July 29, 2019 12:38:27 PM
Attachments: [image001.png](#)
[image002.png](#)
[2019 OK NASA Close Approach Notification v2.docx](#)

Attached please find what we sent over to FEMA, per their request.

V

From: Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>
Sent: Monday, July 29, 2019 12:14 PM
To: Johnson, Alana R. (HQ-NG000)[InuTeq, LLC] <alana.r.johnson@nasa.gov>; Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>; Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>
Cc: Hautaluoma, Grey (HQ-NI000) <grey.hautaluoma-1@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

Yes, this will be more general background and not 2019 OK, but to follow through, I've attached some of the docs prepared for PDC. But also keep in mind that we put a lot of work into the website content at <https://www.nasa.gov/planetarydefense> and the Overview and the sidebar items have a lot of information for writing releases or to point the press to if general questions come in. In particular:

<https://www.nasa.gov/planetarydefense/overview>

<https://www.nasa.gov/planetarydefense/faq>

<https://www.nasa.gov/planetarydefense/did-you-know>

Dr. Kelly Elizabeth Fast

Near-Earth Object Observations Program Manager
Planetary Defense Coordination Office
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Date: Monday, July 29, 2019 at 9:40 AM
To: Lindley Johnson <lindley.johnson@nasa.gov>, "Andrews, Victoria Pidgeon (HQ-CQ000)"

<victoria.p.andrews@nasa.gov>, Kelly Fast <kelly.e.fast@nasa.gov>
Cc: "Hautaluoma, Grey (HQ-NI000)" <grey.hautaluoma-1@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

Thanks, Lindley.

Alana R. Johnson
Senior Communications Specialist
Planetary Science Division
National Aeronautics and Space Administration
Headquarters Washington, D.C.
alana.r.johnson@nasa.gov
O: 202-358-1501
C [REDACTED] b6



From: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Date: Monday, July 29, 2019 at 9:24 AM
To: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
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I think we're thinking about some facts specific to the 2019 OK encounter, but yes you could start with some of the points from PDC for OCOMMS.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Date: Mon, July 29, 2019 8:22 AM -0500
To: "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
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Hello, all.

I think we can dust off and revamp some of the existing talking points from the Planetary Defense Conference.

I may need help to get the latest version, as they existed on JoAnna's computer, and I can't get into her former OneDrive.

VR,
Alana

Alana R. Johnson

Senior Communications Specialist
Planetary Science Division

National Aeronautics and Space Administration

Headquarters Washington, D.C.

alana.r.johnson@nasa.gov

O: 202-358-1501

C: 



From: "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>

Date: Monday, July 29, 2019 at 9:19 AM

To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)"

<kelly.e.fast@nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]"

<alana.r.johnson@nasa.gov>

Subject: RE: [EXTERNAL] Re: Unhappy about Washington Post story

ncluding me in this th



Asteroid 2019 OK Passed Close By Earth 24 July 2019

DETAILS:

Close Approach Date/Time: 25 July 2019, 01:22 UTC (24 July 21:22 EDT)

Close Approach Distance: approximately 48,000 miles (77,000 km)

Approximate Diameter: 180-430 feet (50-130 meters) in diameter

Impact Probability for this Approach: None

The NASA Planetary Defense Coordination Office advises that an asteroid designated 2019 OK safely passed Earth at a distance from its surface of about 45,000 miles (74,000 kilometers), approximately 1/5th the distance from the Earth to the Moon, at 9:22 pm EDT on Wednesday, 24 July 2019. Although small asteroids come between Earth and Moon almost weekly, this object – estimated at between 180 and 430 feet (50 and 130 meters) in size – is unusually large for such a close pass and thus has generated media and public attention.

Asteroid 2019 OK was originally discovered in the evening of July 23rd by SONEAR (Southern Observatory for Near-Earth Asteroids Research), a Brazilian team of asteroid observers, about 24 hours before closest approach. Once follow up observations were obtained by other observatories that evening, “pre-covery” observations were obtained by the NASA-funded Pan-STARRS and ATLAS observatories as far back as 28 June that allowed the orbit to be refined and confirmed the very close approach on the evening of the 24th. This is the closest approach known by an object this size in the last century, and the closest predicted until the close approach of Apophis in April 2029.

NASA has detected less than 25% of the predicted population of near-Earth asteroids of this size range. Detection of 2019 OK was complicated by the fact that it is on a highly elliptical orbit and appeared to not be moving on the plane of sky because of the geometry of the orbit relative to Earth for much of the month prior to the close approach; the complication of a very dim object in a crowded field of stars and the lack of motion made it much harder to detect and calculate an orbit until it was quite close.

2019 OK is now inbound to perihelion and will then travel on its orbit to beyond the orbit of Mars before turning back toward the Sun. It will not pass close by Earth again until the next century, and no additional passes within the Moon’s orbit are currently predicted.

This notification is provided in compliance with NASA Policy Directive (NPD) 8740.1 - *Notification and Communications Regarding Potential Near-Earth Object Threats*. While this object does not present an impact hazard at this time, it passed sufficiently close to garner interest by the media and others.

Further information about 2019 OK can be found on the JPL Center for Near-Earth Object Studies (CNEOS) webpage at <https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2019%20OK1>. For additional information about NASA’s Planetary Defense Coordination Office: www.nasa.gov/planetarydefense.

From: [Johnson, Lindley \(HQ-DG000\)](#)
To: [Andrews, Victoria Pidgeon \(HQ-CQ000\)](#)
Subject: RE: [EXTERNAL] Re: Unhappy about Washington Post story
Date: Monday, July 29, 2019 9:43:44 AM

Send me what you have first. Want to get LA something this morning, and that doesn't need the OCOMMS tweaks.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>
Date: Mon, July 29, 2019 8:42 AM -0500
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CC: "Hautaluoma, Grey (HQ-NI000)" <grey.hautaluoma-1@nasa.gov>
Subject: RE: [EXTERNAL] Re: Unhappy about Washington Post story

I'm working on the 2019 OK encounter now... will send to Alana to merge with the other TPs from Kelly.

V

From: Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>
Sent: Monday, July 29, 2019 9:41 AM
To: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>; Johnson, Alana R. (HQ-NG000) [InuTeq, LLC] <alana.r.johnson@nasa.gov>; Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>
Cc: Hautaluoma, Grey (HQ-NI000) <grey.hautaluoma-1@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

Just jumping in, but I was very good at filing talking points that I reviewed and edited so let me see what I have when things settle down at the workshop.

On: 29 July 2019 08:24, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov> wrote:

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HQ NASA

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I think we can dust off and revamp some of the existing talking points from the Planetary Defense Conference.

I may need help to get the latest version, as they existed on JoAnna's computer, and I can't get into her former OneDrive.

VR,
Alana

Alana R. Johnson
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(HQ-DG000)" <kelly.e.fast@nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq,
LLC]" <alana.r.johnson@nasa.gov>
Subject: RE: [EXTERNAL] Re: Unhappy about Washington Post story

ncluding me in this th

From: [Fast, Kelly E. \(HO-DG000\)](#)
To: [Johnson, Alana R. \(HO-NG000\)](#) [InuTeq, LLC]
Cc: [Johnson, Lindley \(HO-DG000\)](#)
Subject: FW: [EXTERNAL] NASA Morning Briefing for Monday, July 29, 2019
Date: Monday, July 29, 2019 12:51:04 PM

Hi Alana,

As if you need more Just wanted to note that in today's Morning Briefing, there's an article from The Hill that pretty much parrots WaPo by pointing to the Australian sources and propagating wrong information (did not approach from Sun). No effort to talk to NASA down the street.

<https://thehill.com/policy/defense/454915-city-killer-asteroid-just-misses-earth-shocks-scientists>

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
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From: Bulletin Intelligence <nasa@BulletinIntelligence.com>
Date: Monday, July 29, 2019 at 7:03 AM
To: "nasa@BulletinIntelligence.com" <nasa@BulletinIntelligence.com>
Subject: [EXTERNAL] NASA Morning Briefing for Monday, July 29, 2019

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Image removed by sender. NASA Morning Briefing

Monday, July 29, 2019 7:00 AM EDT

Editor's Note

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Today's Table of Contents

Top Stories

- [New Mexico Chiles To Be Grown In Space As Part Of NASA's Advanced Plant Habitat \(Associated Press\)](#)
- [Mars 2020 Rover Flexes Its Arm Ahead Of 2020 Launch \(New Atlas\)](#)
- [Asteroid Zoomed 'Near' Earth Late Wednesday, Astronomers Say \(USA Today\)](#)
- [Used SpaceX Dragon Cargo Ship Arrives At Space Station For Record 3rd Time \(SPACE\)](#)
- [SpaceX Flies Its Starhopper Mars Rocket Prototype For The First Time \(Forbes\)](#)

[Flight](#)

- [No content.](#)

[Earth](#)

- [Do Airplane Contrails Add To Climate Change? Yes, And The Problem Is About To Get Worse.](#)
([NBC News](#))
- [As Earth's High North Blazes With Intense Wildfires, Europe's Heat Is About To Invade The Arctic](#)
([Discover Magazine](#))
- [After Scorching Europe, Heat Wave Is Poised To Melt Greenland](#) ([LiveScience](#))
- [The Delta Aquariid Meteor Shower Begins Its Peak This Weekend](#) ([CNN](#))
- [Alarming Sonar Results Show Glaciers May Be Melting Faster Than We Expected](#) ([Scientific American](#))
- [NASA Finds Two Areas Of Strength In Tropical Storm Nari](#) ([Phys](#))

[Humans in Space](#)

- [New Mexico Chiles To Be Grown In Space As Part Of NASA's Advanced Plant Habitat](#) ([Associated Press](#))
- [NASA Is Planning To Spice Up Space, Literally](#) ([Quartz](#))
- [After First Steps On Moon, Crew Welcomed Home With Aloha](#) ([Associated Press](#))
- [Friendswood Takes Pride In Having 3 Residents At Once In Space](#) ([Houston Chronicle](#))
- [NASA's Forgotten Plan To Land People On Mars In The 1980s](#) ([The Hill](#))
- [Where Does Astronaut Poop Go? Answers To Your Weirdest Questions About Space Travel](#) ([CNN](#))
- [The Coming End Of An Era At NASA](#) ([The Atlantic](#))
- [NASA Astronaut Jessica Meir Making First Voyage To Space In September](#) ([Washington Times](#))
- [These Butter Sculpture Celebrate NASA's Apollo 11 Astronauts And They're Legen-DAIRY!](#)
([LiveScience](#))
- [Hey, Check It Out: Butter Astronauts](#) ([Gizmodo](#))
- [NASA's Apollo 11 Astronauts Honored In...A Butter Sculpture](#) ([CNET News](#))

[Moon to Mars](#)

- [Mars 2020 Rover Flexes Its Arm Ahead Of 2020 Launch](#) ([New Atlas](#))
- [NASA Mars 2020 Rover's Arm Performs 88lbs 'Bicep Curl' On Video](#) ([SlashGear](#))
- [Watch The Mars 2020 Rover Do A Biceps Curl With An 88-pound Turret](#) ([Engadget](#))
- [Mars Sample Return Mission Plans Begin To Take Shape](#) ([Space News](#))
- [NASA's Mars 2020 Rover Looking More And More Like A Rover](#) ([Astronomy Now](#))
- [50 Years After Apollo, India Is Carrying A NASA Laser Reflector To The Moon \(And It's Only The Start\)](#) ([SPACE](#))
- [India Launches Laser Reflector To The Moon 50 Years After Apollo Lunar Landing](#) ([Tech Times](#))
- [Scientists Have Detected Dozens Of Potential Mars Quakes — And The Early Data Suggests Mars May Be Less Earth-like Than We Thought](#) ([Business Insider](#))
- [NASA Fed Apollo 11 Moon Rocks To Cockroaches \(And Then Things Got Even Weirder\)](#) ([SPACE](#))
- [Apollo 11: How 'Dumb Luck' Saved Iconic Moon Photos From Being Destroyed](#) ([Fox News](#))

[Solar System and Beyond](#)

- [The Voyage Of The Beagle And The Future Of Space Science](#) ([Scientific American](#))
- [Asteroid Zoomed 'Near' Earth Late Wednesday, Astronomers Say](#) ([USA Today](#))
- ['It Snuck Up On Us': Scientists Stunned By 'city-killer' Asteroid That Just Missed Earth](#)
([Washington Post](#))
- ['City-killer' Asteroid Just Misses Earth, Shocks Scientists](#) ([The Hill](#))
- [NASA's Planet-Hunting TESS Telescope Finds 21 New Worlds In 1st Year](#) ([SPACE](#))
- [NASA's TESS Mission Completes First Year Of Survey, Turns To Northern Sky](#) ([Phys](#))
- [TESS Completes Survey Of Southern Sky, Marking Halfway Mark Of Mission](#) ([New Atlas](#))

- [Astronomers Have Discovered A Peculiar Rocky Exoplanet With Three Glowing Red Suns \(ScienceAlert\)](#)
- [Editorial: Thumbs Up For Carroll Countian Working On Space Telescope, New Distillery Law, Nonprofit Serving First-responders, Teacher Honors \(Baltimore Sun\)](#)
- [NASA Unveils Amazing Cosmic Views As Chandra X-Ray Observatory Turns 20 \(SPACE\)](#)

[Space Tech](#)

- [NASA Outlines Plans For Lunar Lander Development Through Commercial Partnerships \(SPACE\)](#)
- [NASA Decides Not To Skip Key SLS Test After All \(BGR\)](#)
- [NASA Will Perform A Key 'Green Run' Test Of Its SLS Megarocket After All \(SPACE\)](#)

[Various](#)

- ['Would Dad Approve?' Neil Armstrong's Heirs Divide Over A Lucrative Legacy \(New York Times\)](#)
- [Another Front In The Tensions Between The U.S. And China: Space \(Washington Post\)](#)
- [Apollo 11 Astronaut Michael Collins Tells Tale Of Moon Landing At EAA AirVenture \(Milwaukee Journal Sentinel\)](#)
- [Space Florida To Get Nearly \\$90M In Federal Funding For Infrastructure. \(Orlando Business Journal\)](#)
- [Crist Embraces Role As Florida Space Coast Booster \(Politico\)](#)
- [EXCHANGE: Simulated Astronaut Training Makes Splash At Camp \(Associated Press\)](#)
- [Houston's Space-age Mylar Apollo 11 Art Installation \(CNN\)](#)
- [DARPA's Satellite Servicing Robot To Get Another Shot \(Space News\)](#)

[Other](#)

- [Used SpaceX Dragon Cargo Ship Arrives At Space Station For Record 3rd Time \(SPACE\)](#)
- [SpaceX Dragon Cargo Ship Reaches International Space Station \(CBS News\)](#)
- [SpaceX Flies Its Starhopper Mars Rocket Prototype For The First Time \(Forbes\)](#)
- [SpaceX's Massive Starship Prototype Lifts Off \(CNN\)](#)
- [SpaceX Successfully Flies Starship Rocket After Months Of Testing \(CNBC\)](#)
- [Privately-funded Spacecraft Now Solar Sailing In Earth Orbit \(Spaceflight Now\)](#)
- [Lightsail 2's Successful Deployment Makes It The First Steerable Spacecraft Powered By The Sun \(TIME\)](#)
- [Planetary Society Deploys LightSail 2's Solar Sail. What Does The Future Hold For Solar Sails? \(Universe Today\)](#)
- [Rice Farmers Shocked After Possible Meteorite Crash Lands In Indian Village \(USA Today\)](#)
- [Branson, We Have A Problem ... Virgin Galactic Is Not Ready For Take-off \(Brisbane Times\)](#)
- [OneWeb Satellites Inaugurates Florida Factory \(SPACE\)](#)
- [Israel's Spacecom Looks To Rebound From Rough Patch With Africa Satellite \(Reuters\)](#)
- [China Launches Three Military Satellites, Tests New Rocket Steering Fins \(Spaceflight Now\)](#)
- [France Announces Plan To Launch Satellites With Defensive Lasers, Possibly Submachine Guns \(Gizmodo\)](#)
- [France Wants To Arm Satellites With Guns And Lasers By 2030 \(The Verge\)](#)
- [France's Army Announced It Will Develop 'Space' Machine Guns And Lasers To Counter Cyberattacks \(Business Insider\)](#)

[Top Stories](#)

[New Mexico Chiles To Be Grown In Space As Part Of NASA's Advanced Plant Habitat](#)

[AP](#) (7/27) "A hybrid version of a New Mexico chile plant has been selected to be grown in space as part of a NASA experiment. The chile, from Espanola, New Mexico, is tentatively scheduled to be launched to the International Space Station for testing in March 2020, The Albuquerque Journal reports."

Mars 2020 Rover Flexes Its Arm Ahead Of 2020 Launch

[New Atlas](#) (7/28) "NASA's Mars 2020 rover got a bit of a workout recently as it flexed its mechanical muscles. Captured in a time-lapse video, the 7-ft (2.1 m) robotic arm with its 88-lb (40-kg) "hand" did a bit of curling as space agency engineers guided it from its deployed to its stowed configuration ahead of the unmanned explorer's launch to the Red Planet next year."

Asteroid Zoomed 'Near' Earth Late Wednesday, Astronomers Say

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Used SpaceX Dragon Cargo Ship Arrives At Space Station For Record 3rd Time

[SPACE](#) (7/27) "SpaceX's robotic Dragon cargo capsule arrived at the International Space Station today (July 27), ending a two-day orbital chase and setting a new record for SpaceX's reusable spacecraft. The Dragon, which launched Thursday (July 25) from Florida's Cape Canaveral Air Force Station atop a two-stage Falcon 9 rocket, was captured by the space station's huge robotic arm at 9:11 a.m. EDT (1311 GMT) as both spacecraft sailed 267 miles (430 kilometers) above the coast of southern Chile in South America."

SpaceX Flies Its Starhopper Mars Rocket Prototype For The First Time

[Forbes](#) (7/26, O'Callaghan) "In a historic moment for the company, SpaceX has successfully flown its prototype Mars vehicle called Starhopper and taken a crucial step towards ultimately landing humans on the Red Planet. Late yesterday, July 25 in Boca Chica, Texas, the company's experimental vehicle used its single Raptor engine to hover briefly off the ground, reaching a height of about 20 meters above the ground. The "hop" lasted just seconds but gave us a glimpse of what the future of rocketry may hold."

Flight

No content.

Earth

Do Airplane Contrails Add To Climate Change? Yes, And The Problem Is About To Get Worse.

[NBC News](#) (7/28) "Despite conspiracy theories about so-called chemtrails, there's no evidence that the white plumes seen trailing from high-flying airplanes are part of a secret government program to spray toxic chemicals into the atmosphere for mass sterilization or mind control. But contrails do pose a threat. Scientists say they contribute to climate change by trapping heat that radiates upward from Earth's surface. A new study published in the journal Atmospheric Chemistry and Physics suggests that the global warming effect will triple by 2050 as air travel grows in popularity and new technology enables planes to reach the higher cruising altitudes where contrails tend to form. ... In an ongoing series of flight tests, NASA researchers working with Canadian and German teams found that biofuel blends can reduce soot by up to 70 percent and help minimize formation of contrails."

As Earth's High North Blazes With Intense Wildfires, Europe's Heat Is About To Invade The

Arctic

[Discover Magazine](#) (7/26) "Heat records were obliterated across Western Europe yesterday, with Paris reaching an unfathomable all-time high of nearly 109 degrees. It's the second heat wave in the region in as many months – and this one has been even more brutal than June's. ... This is borne out by the map above from NASA's Goddard Institute for Space Studies. It shows that most of the globe was unusually warm during April through June of this year – and none more so than the high northern latitudes, including Alaska and Siberia."

After Scorching Europe, Heat Wave Is Poised To Melt Greenland

[LiveScience](#) (7/26) "A heat wave that shattered records in Europe this week is on the move, and it could melt billions of tons of ice in Greenland. ... During the 1970s and the 1980s, Greenland lost an average of 50 billion tons (45 billion metric tons) of ice each year. From 2010 to 2018, that figure shot up to an average of 290 billion tons (263 billion metric tons) annually. This summer, the extent of the melt could surpass the record set in 2012. That year, about 97% of the ice sheet's surface thawed, NASA-JPL Caltech reported at the time."

The Delta Aquariid Meteor Shower Begins Its Peak This Weekend

[CNN](#) (7/27, Strickland) "The Delta Aquariid meteor shower puts on one long summer show in July and August, but it will peak at the end of July. ... The Delta Aquariid meteors are more faint than others, and they're more apparent in the Southern Hemisphere, according to NASA. But you can still see them in the Northern Hemisphere's southern latitudes."

Alarming Sonar Results Show Glaciers May Be Melting Faster Than We Expected

[Scientific American](#) (7/26, Leman) "From Alaska to Antarctica, thousands of glaciers flow over the land and out to the ocean. These tidewater glaciers are rapidly retreating and melting, like much of Earth's ice, continually adding to rising sea levels. But to date, scientists have struggled to pinpoint where on the face of a glacier's terminus the most intense melting occurs – and exactly how fast it is happening – because of the difficulty and danger involved in getting close enough to these frozen behemoths. ... "The glacier starts speeding up because it's like removing a plug in front of the glacier," says glaciologist Eric Rignot of the University of California, Irvine, and NASA's Jet Propulsion Laboratory."

NASA Finds Two Areas Of Strength In Tropical Storm Nari

[Phys \(UK\)](#) (7/26) "NASA's Terra satellite found two small areas of strength in Tropical Storm Nari on July 26 as it began to affect Japan. NASA's Terra satellite uses infrared light to analyze the strength of storms by providing temperature information about the system's clouds. The strongest thunderstorms that reach high into the atmosphere have the coldest cloud top temperatures."

Humans in Space

New Mexico Chiles To Be Grown In Space As Part Of NASA's Advanced Plant Habitat

[AP](#) (7/27) "A hybrid version of a New Mexico chile plant has been selected to be grown in space as part of a NASA experiment. The chile, from Española, New Mexico, is tentatively scheduled to be launched to the International Space Station for testing in March 2020, The Albuquerque Journal reports."

NASA Is Planning To Spice Up Space, Literally

[Quartz](#) (7/28) "Space is about to get spicy. The American space agency, NASA, is planning to blast New Mexico chile pepper plants out of the Earth's atmosphere in March 2020 and grow the fruiting blooms on the International Space Station. Researchers hope it will lead to improved meals for

astronauts, as well as a deeper understanding of how to someday grow food on the moon and Mars."

After First Steps On Moon, Crew Welcomed Home With Aloha

[Associated Press](#) (7/28) "Neil Armstrong, Edwin "Buzz" Aldrin and Michael Collins' trip to the moon concluded with a stay in Hawaii. This week marked the 50th anniversary of the moon landing, but after those historic first steps NASA still had to get the three astronauts safely back to Earth – and the waters off Hawaii are where the cone-shaped spacecraft splashed down."

Friendswood Takes Pride In Having 3 Residents At Once In Space

[Houston Chronicle](#) (7/26, Orozco, Writer) "Just as the nation was observing the 50th anniversary of the Apollo 11 on July 20, another crew was headed toward the International Space Station to create an outer-space event that will be remembered as a highlight in Friendswood history. At approximately 12:28 p.m. that day, Friendswood astronaut Andrew Morgan, as well as Luca Parmitano, a member of the European Space Agency who has been living in the city while training at Johnson Space Center, joined Alexander Skvortsov of the Russian space agency Roscosmos, in a space flight launched from the Baikonur Cosmodrome in Kazakhstan."

NASA's Forgotten Plan To Land People On Mars In The 1980s

[The Hill](#) (7/26, Whittington) "Basking in the afterglow of the flight of Apollo 11, NASA set out to examine possibilities for a post-Apollo space program. The Nixon administration had commissioned a study conducted by the Space Task Group comprised of NASA engineers to assess what could be done given the development of Apollo-era technology. The Space Task Group's report, delivered in September 1969, was breathtaking in its scope and ambition."

Where Does Astronaut Poop Go? Answers To Your Weirdest Questions About Space Travel

[CNN](#) (7/27, Trammell) "People have a lot of questions (and misconceptions) about space. It's understandable given that only 573 humans have ever gone there, according to a count by space expert Jonathan McDowell. Still, they shouldn't be the only ones who get to know the truth about what happens in the great beyond. Right?"

The Coming End Of An Era At NASA

[The Atlantic](#) (7/27, Koren) "David Scott, who became the first person to drive on another world in 1971, likened the undisturbed landscape to a picture by the photographer Ansel Adams. "There was no color, but great contrast between the brightly illuminated surface and the black shadow of the mountain slopes and craters where no sunlight fell," he wrote in a 2004 memoir. And the smell! "The moon turned out to have a slightly metallic smell, almost like gunpowder, which pervaded the [lunar module] for the remainder of our trip," Scott recalled."

NASA Astronaut Jessica Meir Making First Voyage To Space In September

[Washington Times](#) (7/28) "Jessica Meir dreamed of being an astronaut when she was 5 years old – now she's going to space for the first time and hopes to walk on the moon in 2024. Ms. Meir, 42, follows in the footsteps of many women before her in NASA, from the sole woman in the control room during the Apollo 11 mission to Sally Ride, the first American woman in space in 1983."

These Butter Sculpture Celebrate NASA's Apollo 11 Astronauts And They're Legen-DAIRY!

[LiveScience](#) (7/27) "The Ohio State Fair is buttering up its visitors with a sculpture series to celebrate the big moon-landing anniversary 50 years ago. The sculptures are of the Apollo 11 moon crew – Neil Armstrong, Buzz Aldrin and Michael Collins – as well as a separate buttery interpretation of Armstrong in his spacesuit by the lunar module, Eagle. There's also a butter cow

and calf standing beside the Apollo 11 patch. This took more than 2,200 pounds (1,000 kilograms) of butter to create."

Hey, Check It Out: Butter Astronauts

[Gizmodo](#) (7/28, McKay) "This year's Ohio State Fair has, par for the course, giant butter sculptures—but this year it has butter astronauts carved to celebrate the recent 50th anniversary of the Apollo 11 mission. Per CNET, visitors to the fair (which began on July 24 and runs until Aug. 4 in Columbus, Ohio) can see huge butter carvings of Apollo 11 crew members Neil Armstrong, Buzz Aldrin, and Michael Collins."

NASA's Apollo 11 Astronauts Honored In...A Butter Sculpture

[CNET News](#) (7/28, Burton) "Life-size butter sculptures of the Apollo 11 space crew are featured in the 2019 butter display presented by the American Dairy Association Mideast. American Dairy Association This story is part of To the Moon, a series exploring humanity's first journey to the lunar surface and our future living and working on the moon."

Moon to Mars

Mars 2020 Rover Flexes Its Arm Ahead Of 2020 Launch

[New Atlas](#) (7/28) "NASA's Mars 2020 rover got a bit of a workout recently as it flexed its mechanical muscles. Captured in a time-lapse video, the 7-ft (2.1 m) robotic arm with its 88-lb (40-kg) "hand" did a bit of curling as space agency engineers guided it from its deployed to its stowed configuration ahead of the unmanned explorer's launch to the Red Planet next year."

NASA Mars 2020 Rover's Arm Performs 88lbs 'Bicep Curl' On Video

[SlashGear](#) (7/28) "NASA has shared a new video of its Mars 2020 rover, one showing off the machine's large arm and its ability to lift heavy payloads. According to the space agency, which shared the video on Friday, the robotic arm was able to lift, curl, and otherwise maneuver a sensor-filled turret that weighed 88lbs. The movement was made possible by five electrical motors working with five mechanical joints."

Watch The Mars 2020 Rover Do A Biceps Curl With An 88-pound Turret

[Engadget](#) (7/28) "Mars 2020's turret weighs that much, because it's equipped with HD cameras and a rich collection of sensors and science instruments, including a percussive drill and coring mechanism. While Martian gravity is only about 38 percent of our planet's, the ground team still made sure the arm is sturdy and strong enough to be able do its task, designing it with five electrical motors and five joints."

Mars Sample Return Mission Plans Begin To Take Shape

[Space News](#) (7/28) "While neither NASA nor the European Space Agency has yet to give formal approval, or funding, for missions to return samples from Mars, both agencies are taking steps to refine plans for what those missions will be. Those plans, discussed at a Mars science conference and working group meeting last week, would involve two launches in 2026 to send spacecraft to fetch samples collected by NASA's Mars 2020 rover and return them to Earth in 2031."

NASA's Mars 2020 Rover Looking More And More Like A Rover

[Astronomy Now \(UK\)](#) (7/28) "Now less than one year from launch, NASA's Mars 2020 rover continues to take shape at the Jet Propulsion Laboratory in Pasadena, Calif. In these three images, cameras captured the rover's robot arm and instrument turret moving from the fully deployed to stowed position; a look inside the electronic heart of the rover where a myriad of wires and other

systems are woven together in a complex assembly; and the spacecraft's generator housing where a nuclear power pack will be installed at the launch pad."

50 Years After Apollo, India Is Carrying A NASA Laser Reflector To The Moon (And It's Only The Start)

[SPACE](#) (7/26) "An Indian spacecraft is carrying the first reflectors to be left on the moon since the Apollo era. The reflectors, which are part of the Indian Space Research Organization's (ISRO) Chandrayaan-2 mission that launched earlier this week, represent the next step in an experiment that began in 1969. ... The new reflector is "a 'microreflector' device, similar to the one delivered by INFN of Italy (through the Italian Space Agency, ASI) to NASA-JPL and deployed on the InSight Mars lander (and to be deployed by the Mars 2020 rover of NASA and by the ExoMars 2020 rover of ESA)," she said."

India Launches Laser Reflector To The Moon 50 Years After Apollo Lunar Landing

[Tech Times](#) (7/28, Hermitanio) "In 1969, Apollo 11 astronauts left lunar lasers on the moon. Decades later, the experiment remains active, with India's Chandrayaan-2 carrying reflectors to its mission to the moon. ... The special laser retroreflector that NASA supplied to ISRO is positioned on the Chandrayaan's Vikram Lander. The new microretroreflector device weighs only 22 grams and can be seen from the lunar orbit. It is similar to the one deployed on the InSight Mars lander."

Scientists Have Detected Dozens Of Potential Mars Quakes — And The Early Data Suggests Mars May Be Less Earth-like Than We Thought

[Business Insider](#) (7/27, McFall-Johnsen) "Scientists have been listening to whispers from below Mars' surface. NASA's InSight lander, which touched down on Mars in November 2018, gave scientists the unprecedented ability to detect and monitor quakes on Mars. The lander's built-in seismometer detected its first quake in April, and since then, researchers have recorded dozens more potential Mars quakes."

NASA Fed Apollo 11 Moon Rocks To Cockroaches (And Then Things Got Even Weirder)

[SPACE](#) (7/26) "It's too weird to make up: NASA fed some of its precious Apollo 11 lunar samples to cockroaches. And dumped it in fishbowls. And injected mice with it. No, really. NASA still has most of the moon rocks the Apollo 11 crew brought home, but a small fraction of the astronauts' bounty was used up in a little-known but vitally important set of experiments that ensured lunar samples were safe to keep here on Earth."

Apollo 11: How 'Dumb Luck' Saved Iconic Moon Photos From Being Destroyed

[Fox News](#) (7/26, Rogers) "The Apollo 11 Moon landing produced some of the most iconic photographs ever taken. However, a processing glitch in Houston when the films were returned to Earth nearly caused a "photographic catastrophe" of truly epic proportions."

Solar System and Beyond

The Voyage Of The Beagle And The Future Of Space Science

[Scientific American](#) (7/22, Hammel, Mountain) "In 1820, the British Royal Navy was the largest in the world, with so many ships that one extra 10-gun brig-sloop lay idle for more than half a decade before it was refitted to conduct hydrographic surveys. She embarked on several voyages, but it was her second trip that catapulted the ship into world-wide renown. Nearly 200 years later schoolchildren learn her name in history and biology classes. ... Like the repurposed Beagle, NASA's new Space Launch System (SLS), designed to send humans beyond Earth's orbit, can also serve another purpose: It can carry robotic spacecraft to the furthest reaches of our solar system."

Asteroid Zoomed 'Near' Earth Late Wednesday, Astronomers Say

[USA Today](#) (7/26, Rice) "A large asteroid 'narrowly' missed the Earth overnight Wednesday, astronomers announced. According to NASA, the space rock was an estimated 187 to 427 feet wide. 'The closest it came to Earth was just under 45,000 miles, a safe distance, but still much less than the distance between the Earth and moon,' Astronomy magazine said. The moon is about 239,000 miles from the Earth."

'It Snuck Up On Us': Scientists Stunned By 'city-killer' Asteroid That Just Missed Earth

[Washington Post](#) (7/26, Chiu) "Alan Duffy was confused. On Thursday, the astronomer's phone was suddenly flooded with calls from reporters wanting to know about a large asteroid that had just whizzed past Earth, and he couldn't figure out 'why everyone was so alarmed.' 'I thought everyone was getting worried about something we knew was coming,' Duffy, who is lead scientist at the Royal Institution of Australia, told The Washington Post. Forecasts had already predicted that a couple of asteroids would be passing relatively close to Earth this week."

'City-killer' Asteroid Just Misses Earth, Shocks Scientists

[The Hill](#) (7/26, Seipel) "This week, Earth had a close call with what some scientists call a "city-killer" asteroid, which, if it had made impact, would have hit the planet with 30 times the power of the atomic bomb that destroyed Hiroshima. Asteroid 2019 OK sped by Earth on Wednesday, flying some 45,000 miles away, inside the orbit of the moon. Scientists were shocked to discover the asteroid only within days of its passing, and only announced its presence hours before it became visible. According to The Washington Post, Asteroid 2019 OK was discovered by two astronomy teams in Brazil and the United States."

NASA's Planet-Hunting TESS Telescope Finds 21 New Worlds In 1st Year

[SPACE](#) (7/26, Bartels) "NASA's TESS mission was designed to hunt alien planets, but it's done more than that in its first year at work, as a new NASA video highlights. Sure, the telescope, which is now halfway through its primary mission, has gathered enough data to let scientists identify 21 new exoplanets already. But in between planet-spotting, the instrument, which is formally called the Transiting Exoplanet Survey Satellite, has also dabbled in the art of catching asteroids and comets — even comets in other solar systems. And TESS has also recording flashes from six different supernovas marking the explosions of dead stars."

NASA's TESS Mission Completes First Year Of Survey, Turns To Northern Sky

[Phys \(UK\)](#) (7/26) "NASA's Transiting Exoplanet Survey Satellite (TESS) has discovered 21 planets outside our solar system and captured data on other interesting events occurring in the southern sky during its first year of science. TESS has now turned its attention to the Northern Hemisphere to complete the most comprehensive planet-hunting expedition ever undertaken."

TESS Completes Survey Of Southern Sky, Marking Halfway Mark Of Mission

[New Atlas](#) (7/26) "TESS was launched on April 18, 2018, from Cape Canaveral Air Force Station atop a SpaceX Falcon 9 rocket with the goal of carrying out the most comprehensive exoplanet survey to date. The successor to the Kepler mission, TESS is tasked with examining"

Astronomers Have Discovered A Peculiar Rocky Exoplanet With Three Glowing Red Suns

[ScienceAlert \(AUS\)](#) (7/28, Starr) "Our Sun is a lone wolf of a star, but out there in the wider Universe, stars are often locked in a dance with others, orbiting a mutual centre of gravity. In one such triple-star system, astronomers have just found an exoplanet."

Editorial: Thumbs Up For Carroll Countian Working On Space Telescope, New Distillery Law, Nonprofit Serving First-responders, Teacher Honors

[Baltimore Sun](#) (7/27) "Thumbs up: With the 50th anniversary of the Apollo 11 moon landing still fresh, we could be forgiven for having stars and planets on our minds. But there's much to be excited about when it comes to space beyond just nostalgia for the golden era of spaceflight. As a huge, glittering, golden example of this, consider the James Webb Space Telescope being developed here in Maryland."

NASA Unveils Amazing Cosmic Views As Chandra X-Ray Observatory Turns 20

[SPACE](#) (7/28) "It's been 20 years since NASA's Chandra X-Ray Observatory launched to give us the sharpest-ever view of X-rays – and the telescope is still working at the frontier of science, the agency said. The observatory, named after the late Nobel laureate Subrahmanyan Chandrasekhar, an Indian American astrophysicist, launched on July 23, 1999."

Space Tech

NASA Outlines Plans For Lunar Lander Development Through Commercial Partnerships

[SPACE](#) (7/28) "As NASA celebrated the 50th anniversary of the first crewed landing on the moon, the agency released new details about how it will procure landers to enable humans to return to the moon in the 2020s. NASA released July 19 a presolicitation notice for its Human Landing System Integrated Lander effort, part of the Next Space Technologies for Exploration Partnerships (NextSTEP) program. The notice included a draft version of a broad agency announcement, with NASA requesting industry comments on it by Aug. 2."

NASA Decides Not To Skip Key SLS Test After All

[BGR](#) (7/28, Wehner) "NASA really, really wants its own rocket. The agency has been shoveling money into a number of programs – including agreements with SpaceX and Boeing to produce crew capsules for manned missions – but above all else it would love for its pricey rocket, the Space Launch System, to reach the finish line. With delays piling up, NASA had apparently been considering fast-tracking the home stretch of its development by skipping a "Green Run" test of its core engines. Now, after giving it some additional thought, the agency has decided to stick with its original plans."

NASA Will Perform A Key 'Green Run' Test Of Its SLS Megarocket After All

[SPACE](#) (7/26) "NASA will indeed perform a lengthy, involved "green run" test of its new Space Launch System (SLS) megarocket ahead of the vehicle's first flight next year, agency chief Jim Bridenstine announced today (July 25). Bridenstine told Congress in March that NASA might skip the green run, a months-long series of tests that culminates with the firing of the SLS core stage's four RS-25 engines for 8 minutes – the duration they'll burn during a launch to the moon."

Various

'Would Dad Approve?' Neil Armstrong's Heirs Divide Over A Lucrative Legacy

[New York Times](#) (7/27, Shane, Kliff, Craig) "Last fall, Neil Armstrong's two sons began a round of media appearances to promote a venture that would make them millions of dollars: a series of auctions of about 3,000 mementos from their father's moon mission and NASA career. "One Giant Sale" was CNBC's headline, playing on the astronaut's famous line, as Mark and Rick Armstrong talked up the items — an American flag that had flown to the moon on Apollo 11; a flight suit their father had worn earlier in his career; and many possessions that had nothing to do with space, including Mr. Armstrong's childhood teddy bear and a preschool report card he signed."

Another Front In The Tensions Between The U.S. And China: Space

[Washington Post](#) (7/26, Davenport) "Fifty years after the United States proved its dominance of space by beating the Soviet Union to landing humans on the moon, the country is confronting the cosmic ambitions of another superpower: China. China didn't launch an astronaut into space until 2003 – more than 40 years after the United States and the Soviet Union did. It has since developed its space program at a torrid pace, even as the United States has become dependent on Russia to maintain a presence on the International Space Station."

Apollo 11 Astronaut Michael Collins Tells Tale Of Moon Landing At EAA AirVenture

[Milwaukee Journal Sentinel](#) (7/26) "Michael Collins' résumé is stellar: Highly decorated test pilot. Astronaut who performed dangerous space walks. West Point graduate and two-star Air Force general. First director of the Smithsonian's Air and Space Museum. But pretty much the only thing everyone seems to remember about him? He's the guy who circled the moon alone in the command module while his two crewmates cavorted on the lunar surface, scooping up rocks, taking pictures, talking to the president and saluting the American flag."

Space Florida To Get Nearly \$90M In Federal Funding For Infrastructure.

[Orlando \(FL\) Business Journal](#) (7/26) "Aerospace economic development agency Space Florida will get almost \$90 million in federal funds for an industrial project through the U.S. Department of Transportation's Infrastructure for Rebuilding America grant program. The funds will be used in Brevard County to replace the Cape Canaveral Spaceport Indian River Bridge with new twin high-level bridges, widen about 2.7 miles of Space Commerce Way and rehabilitate 3.7 miles of NASA Parkway West."

Crist Embraces Role As Florida Space Coast Booster

[Politico](#) (7/26, Feldscher) "Fifty years after the moon landing the Florida Space Coast is preparing to once again play a major role in the nation's space exploration goals – and Rep. Charlie Crist (D-Fla.) says he's working overtime to ensure it remains in the driver's seat. Crist, who served four years as Florida's Republican governor before later switching parties, is now a member of both the House Science, Space and Technology Committee and the House Appropriations subcommittee overseeing NASA."

EXCHANGE: Simulated Astronaut Training Makes Splash At Camp

[Associated Press](#) (7/27) "As the nation celebrates the 50th anniversary of the first moon landing, a potential future generation of space explorers is at the Normal Community West High School pool using training methods similar to those used by astronauts. The 10 students, ages 11 to 14, are participating in the International Space Station Underwater camp offered by the Challenger Learning Center at Heartland Community College."

Houston's Space-age Mylar Apollo 11 Art Installation

[CNN](#) (7/26) "The fanfare surrounding the 50th anniversary of the Apollo 11 moon landing may be waning, but in Houston, home to Apollo's Mission Control, the celebration continues with a spacey art installation. Located in River Oaks District, a high-end, open-air shopping and dining complex in the heart of Houston, the immersive SkyWaves art project is comprised of 4,000 hand-cut mylar flags (the same shiny, durable material that was used to create space blankets in the 1960s). In concert with the Contemporary Art Museum Houston, the project was designed and produced by Matter creative lead and Houstonian Matt Johns and his team of 15."

DARPA's Satellite Servicing Robot To Get Another Shot

[Space News](#) (7/28) "The Defense Advanced Research Projects Agency is considering proposals from potential new partners for its program to send a robot to space to repair satellites. DARPA suffered a major setback in January when Maxar withdrew from the project known as Robotic Servicing of Geosynchronous Satellites, or RSGS. Now the agency wants to give it one more try."

Other

Used SpaceX Dragon Cargo Ship Arrives At Space Station For Record 3rd Time

[SPACE](#) (7/27) "SpaceX's robotic Dragon cargo capsule arrived at the International Space Station today (July 27), ending a two-day orbital chase and setting a new record for SpaceX's reusable spacecraft. The Dragon, which launched Thursday (July 25) from Florida's Cape Canaveral Air Force Station atop a two-stage Falcon 9 rocket, was captured by the space station's huge robotic arm at 9:11 a.m. EDT (1311 GMT) as both spacecraft sailed 267 miles (430 kilometers) above the coast of southern Chile in South America."

SpaceX Dragon Cargo Ship Reaches International Space Station

[CBS News](#) (7/27, Harwood) "Wrapping up a two-day rendezvous, a SpaceX Dragon cargo ship caught up with the International Space Station on Saturday, bringing 5,000 pounds of equipment and supplies to the outpost including a new docking mechanism that will provide a second port for commercial crew ships being built by Boeing and SpaceX. Sailing 260 miles above the southern tip of South America, the unpiloted Dragon pulled up to within about 30 feet of the lab complex and then stood by while astronaut Nick Hague, operating the station's Canadian-built robot arm, locked onto a grapple fixture."

SpaceX Flies Its Starhopper Mars Rocket Prototype For The First Time

[Forbes](#) (7/26, O'Callaghan) "In a historic moment for the company, SpaceX has successfully flown its prototype Mars vehicle called Starhopper and taken a crucial step towards ultimately landing humans on the Red Planet. Late yesterday, July 25 in Boca Chica, Texas, the company's experimental vehicle used its single Raptor engine to hover briefly off the ground, reaching a height of about 20 meters above the ground. The "hop" lasted just seconds but gave us a glimpse of what the future of rocketry may hold."

SpaceX's Massive Starship Prototype Lifts Off

[CNN](#) (7/26, Wattles) "A prototype of SpaceX's Mars rocket roared to life Thursday night, lifting the vehicle into the air for a landmark test. It was the first time the experimental craft, nicknamed "Starhopper," flew free without being tethered to the ground."

SpaceX Successfully Flies Starship Rocket After Months Of Testing

[CNBC](#) (7/26) "SpaceX successfully flew its prototype Starship rocket, the "Starhopper," after aborting a test the night before. After months of testing, the rocket flew a few feet off the ground and landed in Boca Chica Beach, Texas. The flight marks a major milestone for SpaceX as it attempts to send people to the moon and Mars."

Privately-funded Spacecraft Now Solar Sailing In Earth Orbit

[Spaceflight Now](#) (7/26) "A nanosatellite launched aboard SpaceX's Falcon Heavy rocket last month has unfurled a solar sail membrane and is using light pressure from the sun to change its orbit around Earth, pioneering techniques that could be used by future missions traveling to the sun's stellar neighbors. The LightSail 2 spacecraft unfurled a 344-square-foot (32-square meter) solar sail July 23 after a command uplinked by flight controllers at Cal Poly in San Luis Obispo, California, according to the Planetary Society, the space advocacy group that manages the

mission."

Lightsail 2's Successful Deployment Makes It The First Steerable Spacecraft Powered By The Sun

[TIME](#) (7/26) "Humanity might have gotten a tiny bit closer to interstellar travel this week, with a very, very small satellite. That satellite, dubbed LightSail 2 by its creators at the nonprofit Planetary Society, started off as a box about the size of a loaf of bread. And on July 23, the little-cube-that-could deployed a 344 sq. ft. sheet of thin, reflective mylar, becoming the first steerable solar sail ever launched into Earth's orbit."

Planetary Society Deploys LightSail 2's Solar Sail. What Does The Future Hold For Solar Sails?

[Universe Today](#) (7/26) "Where you can travel in space depends on how much propellant you've got on board your rocket and how efficiently you can use it. But there's a source of free propellant right here in the Solar System – the Sun – which is streaming out photons in all directions. You just need to catch them."

Rice Farmers Shocked After Possible Meteorite Crash Lands In Indian Village

[USA Today](#) (7/26, Rodriguez) "A possible meteorite about the size of a football crash-landed in a village in India. The suspected space rock smashed into a paddy field in Mahadeva village in Bihar, located in eastern India, on Monday afternoon, according to the Times of India."

Branson, We Have A Problem ... Virgin Galactic Is Not Ready For Take-off

[Brisbane \(AUS\) Times](#) (7/29) "That historical footnote is the basis of Virgin Galactic's business model. The Virgin SpaceShip Unity finally managed a brief sortie above 50 miles last December, replicating the X-15's achievement 56 years earlier. Unity is an enlarged, passenger version of the privately funded SpaceShipOne rocket plane of 2004, which won the Ansari X Prize by flying above 62 miles."

OneWeb Satellites Inaugurates Florida Factory

[SPACE](#) (7/28) "OneWeb Satellites, the joint venture of Airbus and OneWeb, formally opened its Florida factory that will soon be producing satellites for OneWeb's constellation at the rate of two per day. The July 22 ribbon-cutting ceremony at the 9,750-square-meter factory, located just outside the gates of the Kennedy Space Center here, marked the formal opening of the facility, although its twin production lines are still being commissioned and have yet to start full-scale satellite production."

Israel's Spacecom Looks To Rebound From Rough Patch With Africa Satellite

[Reuters](#) (7/28, Rabinovitch) "Israel's Space Communication Ltd plans a satellite launch next weekend which it hopes will mark a rebound from a couple of major setbacks in recent years. Amos-17, which will provide communication services to Africa, had a total budget including manufacturing, insurance and launch of about \$250 million, and will join three others Spacecom operates."

China Launches Three Military Satellites, Tests New Rocket Steering Fins

[Spaceflight Now](#) (7/26) "China launched a Long March 2C rocket Friday with three Yaogan 30 military satellites, and tested new grid fins on the Long March's first stage to help guide the spent booster away from populated areas. The two-stage Long March 2C rocket lifted off from the Xichang space center in southwestern China's Sichuan province at 0357 GMT Friday (11:57 p.m. EDT Thursday), according to the China Academy of Launch Vehicle Technology, the country's lead

developer of satellite launchers."

France Announces Plan To Launch Satellites With Defensive Lasers, Possibly Submachine Guns

[Gizmodo](#) (7/28, McKay) "An inventor buzzing around on a flyboard clutching a rifle and subsequently borking an attempt to cross the English Channel isn't the only mildly science fiction-y development concerning the French military lately. In the past week, French Defense Minister Florence Parly said that the country would launch miniature surveillance satellites brimming with defensive weaponry in the next few years, with options including spacecraft-mounted lasers and submachine guns under consideration, according to French newspaper Le Point (via Task & Purpose)."

France Wants To Arm Satellites With Guns And Lasers By 2030

[The Verge](#) (7/28) "Earlier this month, French President Emmanuel Macron announced the creation of a French space force that would be responsible for defending its satellites. It looks like they're serious about that: France's Minister of Defense announced a program that would develop nano satellites equipped with guns and lasers, according to Le Point (via Task & Purpose)."

France's Army Announced It Will Develop 'Space' Machine Guns And Lasers To Counter Cyberattacks

[Business Insider](#) (7/28, Moynihan, Goya, France) "With risks to satellites ranging from espionage attempts and jamming to cyber-attacks and anti-satellite weapons, space has simply become another frontier to defend — as well as dramatic repercussions for our ability to communicate, share data, and carry out transactions, interference with satellites could seriously compromise national security. That is why France's minister of defense, Florence Parly, recently announced the launch of a space self-defense and surveillance program with a view to developing patrol nano-satellites and power lasers, according to Le Point."

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From: [Glaze, Lori S. \(HO-DG000\)](#)
To: [Johnson, Lindley \(HO-DG000\)](#); [Johnson, Alana R. \(HO-NG000\)](#) [InuTeq, LLC]
Cc: [Fast, Kelly E. \(HO-DG000\)](#); [Andrews, Victoria Pidgeon \(HO-CO000\)](#)
Subject: Re: Close approach of sizable asteroid
Date: Wednesday, July 24, 2019 9:22:26 PM

Thanks for the alert. I'll forward to Thomas.

Dr. Lori S. Glaze
Director, Planetary Science Division
NASA

Lori.S.Glaze@nasa.gov
202-358-1588

On: 24 July 2019 17:52, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
wrote:

Because there may be media coverage tomorrow, I'm alerting you that in about 30 mins a 57-130 meter sized asteroid will pass Earth at only 0.19 lunar distances (~48,000 miles). 2019 OK was spotted about 24 hrs ago by SONEAR, a Brazilian team of pro-ams. Once reported to MPC and put on NEO Confirmation Page, both Pan-STARRS and ATLAS were able to find pre-recovery observations back to June 28, and CNEOS at JPL determined this close approach tonight. It has just been cataloged by MPC and is now up on the websites.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

From: Johnson, Lindley (HQ-DG000)
To: [REDACTED] (NATIONAL INSTITUTE OF AEROSPACE); Fast, Kelly E. (HQ-DG000)
Subject: RE: [EXTERNAL] about 2019 OK
Date: Monday, July 29, 2019 3:47:00 PM
Attachments: [2019 OK NASA Close Approach Notification v2.docx](#)

Here is a “fact sheet” in the form of a Notification Message that might have been/be sent out on 2019 OK.

Lindley N. Johnson
Planetary Defense Officer
Planetary Science Division
Science Mission Directorate
HQ NASA
202 358-2314
Lindley.Johnson@nasa.gov

Hic Servare Diem

See Planetary Defense at NASA: <http://www.nasa.gov/planetarydefense/overview>

From: [REDACTED] >
Sent: Monday, July 29, 2019 12:29 PM
To: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>; Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>
Subject: [EXTERNAL] about 2019 OK

Okay, I've been following the email thread about this story, am happy to reach out to reporters about where to go for accurate info -- Liam Mannix, Sydney Morning Herald, Allyson Chiu, WaPo, etc. I'm going to ask Tim to help me get my facts straight.

Pretty much all of what I've seen is a plain old repetition of the Sydney Morning Herald story of last week, including the latest, regurgitated in the Epoch Times, a dubious news source based in NYC, founded and run by Chinese Falun Gong followers and strongly right-leaning and rabidly anti-Communist-China.

And we're obviously talking here about a broader long-term communication strategy for planetary defense -- and I'm not sure that OCOMMS will back us up. What do you think? The astrobiology team's interactions with Grey Hautaloma thus far have not been good. What is your take on this guy? We're really gonna miss Dwayne.... And then there's the whole "Moon 2024" thing....

[REDACTED] Ph.D.
Consultant to NASA's Astrobiology Program and Planetary Defense Coordination Office
National Institute of Aerospace
ph. [REDACTED] (mobile)



Asteroid 2019 OK Passed Close By Earth 24 July 2019

DETAILS:

Close Approach Date/Time: 25 July 2019, 01:22 UTC (24 July 21:22 EDT)

Close Approach Distance: approximately 48,000 miles (77,000 km)

Approximate Diameter: 180-430 feet (50-130 meters) in diameter

Impact Probability for this Approach: None

The NASA Planetary Defense Coordination Office advises that an asteroid designated 2019 OK safely passed Earth at a distance from its surface of about 45,000 miles (74,000 kilometers), approximately 1/5th the distance from the Earth to the Moon, at 9:22 pm EDT on Wednesday, 24 July 2019. Although small asteroids come between Earth and Moon almost weekly, this object – estimated at between 180 and 430 feet (50 and 130 meters) in size – is unusually large for such a close pass and thus has generated media and public attention.

Asteroid 2019 OK was originally discovered in the evening of July 23rd by SONEAR (Southern Observatory for Near-Earth Asteroids Research), a Brazilian team of asteroid observers, about 24 hours before closest approach. Once follow up observations were obtained by other observatories that evening, “precovery” observations were obtained by the NASA-funded Pan-STARRS and ATLAS observatories as far back as 28 June that allowed the orbit to be refined and confirmed the very close approach on the evening of the 24th. This is the closest approach known by an object this size in the last century, and the closest predicted until the close approach of Apophis in April 2029.

NASA has detected less than 25% of the predicted population of near-Earth asteroids of this size range. Detection of 2019 OK was complicated by the fact that it is on a highly elliptical orbit and appeared to not be moving on the plane of sky because of the geometry of the orbit relative to Earth for much of the month prior to the close approach; the complication of a very dim object in a crowded field of stars and the lack of motion made it much harder to detect and calculate an orbit until it was quite close.

2019 OK is now inbound to perihelion and will then travel on its orbit to beyond the orbit of Mars before turning back toward the Sun. It will not pass close by Earth again until the next century, and no additional passes within the Moon’s orbit are currently predicted.

This notification is provided in compliance with NASA Policy Directive (NPD) 8740.1 - *Notification and Communications Regarding Potential Near-Earth Object Threats*. While this object does not present an impact hazard at this time, it passed sufficiently close to garner interest by the media and others.

Further information about 2019 OK can be found on the JPL Center for Near-Earth Object Studies (CNEOS) webpage at <https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2019%20OK1>. For additional information about NASA’s Planetary Defense Coordination Office: www.nasa.gov/planetarydefense.

From: Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]
To: Johnson, Lindley (HQ-DG000); Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]
Cc: McCartney, Gretchen P (JPL-1821)[Jet Propulsion Laboratory]; Agle, David C (JPL-1821)[Jet Propulsion Laboratory]; Hautaluoma, Grey (HQ-NI000); Fast, Kelly E. (HQ-DG000)
Subject: Re: [EXTERNAL] About Asteroid over Canada
Date: Monday, July 29, 2019 6:36:00 PM

I've been told the GMA segment did not air this morning, but is likely to air tomorrow morning. The show runs from 7:00am to 9:00am, and it could air any time within that window.

I hope their take on the story is ok. We'll see...

The All Things Considered interview fell through, so nothing there.

Paul

Dr. Paul W. Chodas
Manager, Center for Near Earth Object Studies
Jet Propulsion Laboratory
301-121
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-7795 Office
 Cell

From: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Date: Monday, July 29, 2019 at 6:21 AM
To: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Cc: "McCartney, Gretchen P (US 1821)" <gretchen.p.mccartney@jpl.nasa.gov>, "Agle, David C (US 1821)" <david.c.agle@jpl.nasa.gov>, "Hautaluoma, Grey (HQ-NI000)" <grey.hautaluoma-1@nasa.gov>, "EXTERNAL-Fast, Kelly (US 9300-NASA)" <Kelly.E.Fast@nasa.gov>
Subject: Re: [EXTERNAL] About Asteroid over Canada

Could you ask them about what time it might air? Would like to try to catch it.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>

Date: Mon, July 29, 2019 6:32 AM -0500
To: "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>
CC: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "McCartney, Gretchen P (JPL-1821)[Jet Propulsion Laboratory]" <gretchen.p.mccartney@jpl.nasa.gov>, "Agle, David C (JPL-1821)[Jet Propulsion Laboratory]" <david.c.agle@jpl.nasa.gov>, "Hautaluoma, Grey (HQ-NI000)" <grey.hautaluoma-1@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Subject: Re: [EXTERNAL] About Asteroid over Canada

Hi, all.

The GMA producer let us know the segment will air tomorrow.

Thank you all!

Alana

Alana R. Johnson
Senior Communications Specialist
Planetary Science Division
National Aeronautics and Space Administration
Headquarters Washington, D.C.
alana.r.johnson@nasa.gov
Cell 

On: 29 July 2019 02:25, "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov> wrote:

Hi Alana,

Just to reinforce Kelly's response, the reported fireball over Canada, or anywhere else for that matter, had nothing to do with 2019 OK, which passed by the Earth on July 24. I hadn't heard about the event in India, but even if it is an accurate story, it would have nothing to do with the asteroid 2019 OK. There is no way, for example, that a piece broke off of 2019 OK and went on to impact somewhere.

FYI, I was interviewed for a GMA segment tomorrow morning, standing out in the parking lot of the local ABC affiliate with the TV transmission dishes as backdrop. The media seems to think that we use radar dishes to scan for asteroids! We have to emphasize that discoveries are made optically! Having said that, we had enough advance notice of the close approach that the Arecibo antenna successfully detected 2019 OK with radar.

Best,

Paul

Dr. Paul W. Chodas
Manager, Center for Near Earth Object Studies
Jet Propulsion Laboratory
301-121
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-7795 Office
 Cell

From: "Fast, Kelly E. (HQ-DG000)" <Kelly.E.Fast@nasa.gov>
Date: Sunday, July 28, 2019 at 8:33 PM
To: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Cc: "McCartney, Gretchen P (US 1821)" <gretchen.p.mccartney@jpl.nasa.gov>, "Agle, David C (US 1821)" <david.c.agle@jpl.nasa.gov>, "Hautala, Grey (HQ-NI000)" <grey.hautala-1@nasa.gov>
Subject: Re: [EXTERNAL] About Asteroid over Canada

Hi Alana,

There was a fireball over Ontario, Canada the other night:

<https://news.westernu.ca/2019/07/fireball-space-meteor-ontario>

As for the meteorite story from India, there have been others that were not what was claimed, but the fireball over Canada would have nothing to do with anything in India regardless.

Kelly

Dr. Kelly Elizabeth Fast
[Near-Earth Object Observations](#) Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Date: Sunday, July 28, 2019 at 10:39 PM

To: Lindley Johnson <lindley.johnson@nasa.gov>, Kelly Fast <kelly.e.fast@nasa.gov>, "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>
Cc: "McCartney, Gretchen P (JPL-1821)[Jet Propulsion Laboratory]" <gretchen.p.mccartney@jpl.nasa.gov>, "Agle, David C (JPL-1821)[Jet Propulsion Laboratory]" <david.c.agle@jpl.nasa.gov>, "Hautaluoma, Grey (HQ-NI000)" <grey.hautaluoma-1@nasa.gov>
Subject: Fwd: [EXTERNAL] About Asteroid over Canada

Hello, Planet Defenders!

For your awareness—Gretchen and I received an email referencing an asteroid hit in Canada and India? In all of the discussions about the fly by last week, I never heard specific reference to either country.

Vr
Alana

Alana R. Johnson
Senior Communications Specialist
Planetary Science Division
National Aeronautics and Space Administration
Headquarters Washington, D.C.
alana.r.johnson@nasa.gov
Cell 

Begin Forwarded Message:

From:  "  alana.r.johnson@gmail.com>
Subject: [EXTERNAL] About Asteroid over Canada
Date: 27 July 2019 22:58
To: "McCartney, Gretchen P (JPL-1821)[Jet Propulsion Laboratory]" <gretchen.p.mccartney@jpl.nasa.gov>, "Johnson, Alana R. (HQ-NG000) [InuTeq, LLC]" <alana.r.johnson@nasa.gov>

Hi Gretchen and Alana,

Good day.

Got your mail Id from NASA website, saw a news about asteroid hitting Canada on July 24 at 3 AM local time, at about sametime there is a report of asteroid falling at farmer's field in Indian state of Bihar.

Guess already you might have received the information but if not then

surely can check in below link. If this fallen asteroid is part of same asteroid that entered Canada and disintergrated and fell at Bihar, that's a lot of travel and just reinforces the fear of destruction that if bigger meteor enters Earth it can split and fall at different locations and cause total destruction.

Here is the link-

<https://www.google.com/amp/s/www.ndtv.com/india-news/farmers-shocked-as-suspected-meteorite-crashes-in-rice-field-in-bihar-2076047%3famp=1&akamai-rum=off>

Regards,



From: Johnson, Lindley (HQ-DG000)
To: 
Cc: Fast, Kelly E. (HQ-DG000); 
Subject: RE: [EXTERNAL] Ammo (more) for IR survey scope
Date: Thursday, July 25, 2019 11:22:00 AM

Sounds good.

Lindley N. Johnson
Planetary Defense Officer
Planetary Science Division
Science Mission Directorate
HQ NASA
202 358-2314
Lindley.Johnson@nasa.gov

Hic Servare Diem

See Planetary Defense at NASA: <http://www.nasa.gov/planetarydefense/overview>

From:  < gmail.com>
Sent: Thursday, July 25, 2019 11:17 AM
To: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>
Cc: Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>;   @gmail.com>
Subject: Re: [EXTERNAL] Ammo (more) for IR survey scope

I agree with you on the faintness in the one set of images--below threshold seems likely. The others seem more interesting.  if that's ok?



On Thu, Jul 25, 2019 at 11:13 AM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

Hmmm....I don't think it was gaps and fill factor for this one. The MPEC shows they had six precovery detections in a quick row on June 28th, albeit at 22-23 Mv. I would guess maybe too dim for their auto-processing.

Yes, please ask them both why they think it was not picked up, by PS on June 28 and July 7th, and ATLAS on July 21st (when really bright!).

Again, not accusatory but just looking to understand so maybe we do better in future. Missing one this large coming this close **is not** "OK".

Lindley N. Johnson
Planetary Defense Officer
Planetary Science Division
Science Mission Directorate
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202 358-2314
Lindley.Johnson@nasa.gov

Hic Servare Diem

See Planetary Defense at NASA: <http://www.nasa.gov/planetarydefense/overview>

From:  >
Sent: Thursday, July 25, 2019 10:59 AM
To: Johnson, Lindley (HQ-DG000) <Lindley.Johnson@nasa.gov>
Cc: Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>  >
Subject: Re: [EXTERNAL] Ammo (more) for IR survey scope

Hi Lindley, first off I estimated 4-5 Tunguskas for this object, but only by using 's site and guestimating!! I'd be curious your more learned analysis.

RE why was this missed. For Pan-STARRS, the fill factor just absolutely kills them. This is why I hammered Sentinel on their cadence, and also really worked hard with LSST folks through . The fill factor is the most important quantity in these cases. Pan-STARRS requires 4/4 or 3/4 detections. With a fill factor of, say, 75%, that means to get all 4 detections in the clear you have a probability of $.75^4 = 31\%!!$ In short, Pan-STARRS is 31% efficient if requiring 4 images. If we let them have 3, $.75^3 = 42\%$. In either case they miss more than half of the NEOs in their field of view with a fill factor under about 85%. This is why they are/were asking for a better camera--another topic for another day.

As for ATLAS, I'm not entirely sure. It may have only appeared on 3 of their frames? That is a dense star field.

Now, as you can see, the Pan-STARRS folks did have the detections in the clear. I think because they have such a noisy chip they run at higher SNR ratios for detection. That explains the fainter one--below threshold. But the other one, no idea.

Regarding fill factor, best to get that number from them to be sure. 5% improvement translates to large improvement.

I can ask for how this transpired if you want?

BTW this is why I've always wanted large, monolithic, clean chips. Chip gaps contribute to fill factor...

Is this what you're looking for for now or do you want me to drop them a line?



On Thu, Jul 25, 2019 at 10:33 AM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

I'd like a short, informal look at why Pan-STARRS and ATLAS didnt get a discovery of 2019 OK. They clearly got detections when told where to look, almost a month earlier by PS. It appears to have been moving very slowly, but why no detection by them? Not wanting to blame anyone - just for understanding why.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: [REDACTED] <[REDACTED]>
Date: Wed, July 24, 2019 5:47 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>, [REDACTED] <[REDACTED]>
Subject: [EXTERNAL] Ammo (more) for IR survey scope

100 meter object discovered 2 days from close approach--missed by the big surveys because it was in the Milky Way and monsoon approaching.

This is the kind of thing that would keep me up at night at the MPC.

MPEC coming shortly. The object is currently on the NEOCP under S511618.

[REDACTED]

From: Johnson, Lindley (HQ-DG000)
To:  Fast, Kelly E. (HQ-DG000)
Subject: Re: [EXTERNAL] Asteroid 2019 OK
Date: Friday, July 26, 2019 2:05:47 PM

Actually, it wasn't discovered in June,  Yes, we now have obs from the end of June because Pan-STARRS found some precovery obs after the discovery by SONEAR on July 24th.

This one did sneak up on us and it is an interesting story on the limitations of our current survey network.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From:  <.com>
Date: Fri, July 26, 2019 1:03 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Subject: [EXTERNAL] Asteroid 2019 OK

Hi Lindley and Kelly,

I see on CNEOS this asteroid was found at the end of this past June. Article is saying earlier this week was when it was found.

And this Duffy guy doesn't give much credence to nuke mitigation. I guess that's what makes horse races! :)

Interested in what you know...

Best,



'It snuck up on us': Scientists stunned by 'city-killer' asteroid that just missed Earth
Allyson Chiu

An undated image of an asteroid in space. NASA confirmed that on July 25, Asteroid 2019 OK passed about 73,000 kilometers from Earth, roughly one-fifth the distance to the moon. (Cover Images/ AP)

Alan Duffy was confused. On Thursday, the astronomer's phone was suddenly flooded with calls from reporters wanting to know about a large asteroid that had just whizzed past Earth, and he couldn't figure out "why everyone was so alarmed."

“I thought everyone was getting worried about something we knew was coming,” Duffy, who is lead scientist at the Royal Institution of Australia, told The Washington Post. Forecasts had already predicted that a couple of asteroids would be passing relatively close to Earth this week.

Then, he looked up the details of the hunk of space rock named Asteroid 2019 OK.

“I was stunned,” he said. “This was a true shock.”

This asteroid wasn’t one that scientists had been tracking, and it had seemingly appeared from “out of nowhere,” Michael Brown, a Melbourne-based observational astronomer, told The Washington Post. According to data from NASA, the craggy rock was large, an estimated 57 to 130 meters wide (187 to 427 feet), and moving fast along a path that brought it within about 73,000 kilometers (45,000 miles) of Earth. That’s less than one-fifth of the distance to the moon and what Duffy considers “uncomfortably close.”

“It snuck up on us pretty quickly,” said Brown, an associate professor in Australia with Monash University’s School of Physics and Astronomy. He later noted, “People are only sort of realizing what happened pretty much after it’s already flung past us.”

The asteroid’s presence was discovered only earlier this week by separate astronomy teams in Brazil and the United States. Information about its size and path was announced just hours before it shot past Earth, Brown said.

“It shook me out of my morning complacency,” he said. “It’s probably the largest asteroid to pass this close to Earth in quite a number of years.”

So how did the event almost go unnoticed?

First, there’s the issue of size, Duffy said. Asteroid 2019 OK is a sizable chunk of rock, but it’s nowhere near as big as the ones capable of causing an event like the dinosaurs’ extinction. More than 90 percent of those asteroids, which are more than half a mile wide or larger, have already been identified by NASA and its partners.

“Nothing this size is easy to detect,” Duffy said of Asteroid 2019 OK. “You’re really relying on reflected sunlight, and even at closest approach it was barely visible with a pair of binoculars.”

Brown said the asteroid’s “eccentric orbit” and speed were also likely factors in what made spotting it ahead of time challenging. Its “very elliptical orbit” takes it “from beyond Mars to within the orbit of Venus,” which means the amount of time it spends near Earth where it is detectable isn’t long, he said. As it approached Earth, the asteroid was traveling at about 24 kilometers per second, he said, or nearly 54,000 mph. By contrast, other recent asteroids that flew by Earth clocked in between 4 and 19 kilometers per second (8,900 to 42,500 mph).

“It’s faint for a long time,” Brown said of Asteroid 2019 OK. “With a week or two to go, it’s getting bright enough to detect, but someone needs to look in the right spot. Once it’s finally

recognized, then things happen quickly, but this thing's approaching quickly so we only sort of knew about it very soon before the flyby."

The last-minute detection is yet another sign of how much remains unknown about space and a sobering reminder of the very real threat asteroids can pose, Duffy said.

"It should worry us all, quite frankly," he said. "It's not a Hollywood movie. It is a clear and present danger."

Duffy said astronomers have a nickname for the kind of space rock that just came so close to Earth: "City-killer asteroids." If the asteroid had struck Earth, most of it would have probably reached the ground, resulting in devastating damage, Brown said.

"It would have gone off like a very large nuclear weapon" with enough force to destroy a city, he said. "Many megatons, perhaps in the ballpark of 10 megatons of TNT, so something not to be messed with."

In 2013, a significantly smaller meteor — about 20 meters (65 feet) across, or the size of a six-story building — broke up over the Russian city of Chelyabinsk and unleashed an intense shock wave that collapsed roofs, shattered windows and left about 1,200 people injured. The last space rock to strike Earth similar in size to Asteroid 2019 OK was more than a century ago, Brown said. That asteroid, known as the Tunguska event, caused an explosion that leveled 2,000 square kilometers (770 square miles) of forest land in Siberia.

Although the chances of a large asteroid landing on a city are "modest," Brown said it is still worthwhile to devote resources toward detection and prevention. Brown said Asteroid 2019 OK proves there are "still dangerous asteroids out there that we don't know of" that "can arrive on our doorstep unannounced."

Scientists are working on developing at least two approaches to deflecting potentially harmful asteroids, Duffy said. One strategy involves gently pushing the asteroid slowly over time off its course and away from Earth, he said. The other, which he called a "very elegant solution," is the gravity tractor. If an asteroid is detected early enough, it could be possible to divert it using the gravity of a spacecraft, according to NASA.

People shouldn't try to "blast it with a nuke," Duffy said.

"It makes for a great Hollywood film," he said. "The challenge with a nuke is that it may or may not work, but it would definitely make the asteroid radioactive."

In light of Asteroid 2019 OK, Duffy stressed the importance of investing in a "global dedicated approach" to detecting asteroids because "sooner or later there will be one with our name on it. It's just a matter of when, not if."

"We don't have to go the way of the dinosaurs," he said. "We actually have the technology to find and deflect certainly these smaller asteroids if we commit to it now."

Emily Lakdawalla, senior editor of the Planetary Society, which promotes space exploration, said the recent near miss is a reminder that “it’s an important activity to be watching the skies.” The more that can be learned about an asteroid, the better prepared people can be to prevent potential disasters, she told The Post.

Still, Lakdawalla said that while the asteroid’s close brush with Earth may have sparked some concern, “it is zero percent danger to us.”

“It’s the kind of thing where you learn about something that you didn’t know about, like things flying close by us, and your inclination is to be scared,” she said. “But just like sharks in the ocean, they’re really not going to hurt you and they’re really fascinating to look at.”

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From: [Johnson, Lindley \(HQ-DG000\)](#)
To: [Johnson, Alana R. \(HQ-NG000\)\[InuTeq, LLC\]](#); [Fast, Kelly E. \(HQ-DG000\)](#)
Subject: Re: [EXTERNAL] NASA Morning Briefing for Tuesday, July 30, 2019
Date: Tuesday, July 30, 2019 3:34:13 PM
Attachments: [image001.png](#)
[image002.png](#)

I suspected that the news cycle had already moved on.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Date: Tue, July 30, 2019 2:31 PM -0500
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Subject: Re: [EXTERNAL] NASA Morning Briefing for Tuesday, July 30, 2019

I need to follow up with the producer. She said the shooting over the weekend took over everything else.

Alana R. Johnson
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C: 



From: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Date: Tuesday, July 30, 2019 at 3:20 PM
To: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Subject: Re: [EXTERNAL] NASA Morning Briefing for Tuesday, July 30, 2019

We heard the GMA segment didn't air today. Is that true?

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Date: Tue, July 30, 2019 2:15 PM -0500
To: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Subject: Re: [EXTERNAL] NASA Morning Briefing for Tuesday, July 30, 2019

Wow....and it was NBC's Chip Reid who did that big piece with Lori during the PDCO!!!!

Alana R. Johnson
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C: [REDACTED]



From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Tuesday, July 30, 2019 at 7:28 AM
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Subject: FW: [EXTERNAL] NASA Morning Briefing for Tuesday, July 30, 2019

Now it's NBC parroting WaPo. Goodness, pretty sad. I hope that ABC and GMA do a good job with Paul Chodas' interview.

<https://www.nbcnews.com/mach/science/how-astronomers-missed-huge-asteroid-just-flew-unexpectedly-earth-ncna1035721>

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: Bulletin Intelligence <nasa@BulletinIntelligence.com>
Date: Tuesday, July 30, 2019 at 7:01 AM
To: "nasa@BulletinIntelligence.com" <nasa@BulletinIntelligence.com>
Subject: [EXTERNAL] NASA Morning Briefing for Tuesday, July 30, 2019

[Click to access iPhone-optimized online version, download options, archive and an audio reader.](#)

<http://nasa.bulletinintelligence.com/briefing?d=2019-07-30&doctypecode=nasa>

Image removed by sender. NASA Morning Briefing



Tuesday, July 30, 2019 7:00 AM EDT

Editor's Note

To subscribe or unsubscribe, please visit: <http://nasa.bulletinintelligence.com/subscribe>. A NASA email address is required.

Today's Table of Contents

Top Stories

- [NASA Seeks To Break The "Tyranny Of Launch" With In-space Manufacturing \(Ars Technica\)](#)
- [Planet-Hunting Satellite TESS Finds 'Missing Link' Exoplanets \(CNN\)](#)
- [After Years Of Sexism In Space We Urgently Need More Female Astronauts \(New Scientist\)](#)
- [Most Federal Agencies Lack Cybersecurity Strategies, Says Report \(Washington Times\)](#)

Flight

- [No content.](#)

Earth

- [NASA Tropical Storm Erick Strengthening \(Phys\)](#)
- [NASA Takes Tropical Storm Flossie's Temperature \(Phys\)](#)
- [Column: As The Arctic Warms, Wildfires Spread Toxic Air Pollution Far And Wide \(Buffalo News\)](#)
- [Changes In Earth's Gravity Field: Unique Data Series Will Be Continued \(Phys\)](#)
- [NASA Tracks Wildfires From Above To Aid Firefighters Below \(Phys\)](#)

Humans in Space

- [After Years Of Sexism In Space We Urgently Need More Female Astronauts \(New Scientist\)](#)
- [NASA Wants To Grow Fruit In Space \(Fox News\)](#)
- [Photos: SpaceX Completes Resupply Run To International Space Station \(Spaceflight Now\)](#)
- [Docking Mechanism, Other Dragon Cargo Arrives At ISS \(Aviation Week\)](#)
- [This Company Says It Has A Lunar Space Suit That Will Be Ready For NASA's 2024 Moon Mission \(The Verge\)](#)

Moon to Mars

- [NASA Fed Some Of Its Precious Apollo 11 Lunar Samples To Cockroaches \(CNN\)](#)
- [NASA Fed Apollo 11 Moon Rocks To Cockroaches \(And Then Things Got Even Weirder\) \(LiveScience\)](#)
- [Mysteries Of The Moon: What We Still Don't Know After Apollo \(Fox News\)](#)
- [Bringing Pieces Of Mars To Earth In 2031: How NASA And Europe Plan To Do It \(SPACE\)](#)
- [Historian Unveils Never-Seen Footage Of Armstrong And Aldrin On The Moon \(Air & Space Smithsonian Magazine\)](#)
- [NASA Outlines Plans For Lunar Lander Development Through Commercial Partnerships \(SPACE\)](#)
- [Commercial Lunar Lander Company Terminates NASA Contract \(Space News\)](#)
- [NASA's Mars 2020 Rover Does Biceps Curls \(Phys\)](#)
- [NASA's Mars 2020 Rover Is Already Getting A Workout Without Leaving Earth \(BGR\)](#)
- [This Apollo 11 Experiment Is Still Happening On The Moon \(CNN\)](#)

Solar System and Beyond

- [TESS Successfully Completes First Year Of Science Operations \(Sci-News\)](#)
- [NASA TESS Mission Completes Its First Year Of Scanning The Sky \(SlashGear\)](#)
- [Planet-Hunting Satellite TESS Finds 'Missing Link' Exoplanets \(CNN\)](#)
- [NASA's Planet-Hunting Satellite Discovers 'Rare' New World \(U.S. News & World Report\)](#)
- [NASA's Newest Planet-hunting Telescope Just Discovered A 'Super-Earth' And 2 'Sub-Neptunes' Less Than 75 Light-years Away \(Business Insider India\)](#)
- [Distant Alien Planet With Three Red Suns Discovered \(Fox News\)](#)
- [NASA Telescope Discovers Three Intriguing Planets Hiding Around Nearby Star \(CNET News\)](#)
- [New Young Gas-giant Planet Discovered By Nasa's TESS Satellite \(BBC News Online\)](#)
- [NASA's TESS Mission Finds Three Nearby 'oven-hot' Exoplanets \(SlashGear\)](#)
- [NASA's TESS Satellite Spots 'Missing Link' Exoplanets \(New York Times\)](#)
- [NASA's TESS Discovers 'Super-Earth' and Two Other Exoplanets Just 73 Light Years Away \(Newsweek\)](#)
- [NASA's TESS Telescope Spots 2 'Missing Link' Exoplanets \(and A Super Earth, Too!\) \(SPACE\)](#)
- [NASA Discovers Three New Planets Nearby \(Daily Mirror\)](#)
- [NASA's Newest Planet-hunting Telescope Just Discovered A 'Super-Earth' And 2 'Sub-Neptunes' Less Than 75 Light-years Away – Among The Closest Exoplanets Ever Found \(Business Insider\)](#)
- [NASA Planet Hunter Spots Intriguing Trio Around Nearby Star \(CNET News\)](#)
- [NASA's TESS Mission Finds 'Missing Link' Planets \(Phys\)](#)
- [NASA's TESS Mission Finds 'Missing Link' Planets \(Astrobiology Magazine\)](#)
- [Three Newly Discovered Exoplanets Orbit A Star 73 Light Years Away \(New Scientist\)](#)
- [TESS Discovers Three New Planets Nearby, Including Temperate 'Sub-Neptune': Planetary](#)

[System Orbiting An Unusually Quiet Star Is Ideal For Future Habitability Searches \(Science Daily\)](#)

- [How Salts On The Surface Could Aid In Modeling Europa's Ocean \(Astrobiology Magazine\)](#)
- [Gravitational Waves Could Guide Space 'Hitchhikers' To A Magrathea-Like World \(SPACE\)](#)
- [How Astronomers Missed The Huge Asteroid That Just Flew Unexpectedly By Earth \(NBC News\)](#)
- [Hubble Space Telescope Sees NGC 3432: Edge-On And Distorted \(Sci-News\)](#)
- [After Moon Landing Anniversary, NASA Aims Beyond Earth Orbit \(Voice of America\)](#)

[Space Tech](#)

- [NASA's New Lightweight X-ray Mirrors Ready For Try-outs In Space \(Phys\)](#)
- [NASA Seeks To Break The "Tyranny Of Launch" With In-space Manufacturing \(Ars Technica\)](#)

[Various](#)

- [Most Federal Agencies Lack Cybersecurity Strategies, Says Report \(Washington Times\)](#)

[Other](#)

- [JAXA To Launch Eighth HTV Space Station Cargo Mission In September \(Spaceflight Now\)](#)
- [Watch Japan's Hayabusa2 Wild Smash And Grab Landing On Asteroid Ryugu \(CNET News\)](#)
- [Elon Musk Says A SpaceX Starship Design Update Is Coming In Mid-August \(SPACE\)](#)
- [Elon Musk Drops Fresh Update On SpaceX's Mission To Mars \(Daily Express\)](#)

[Top Stories](#)

NASA Seeks To Break The "Tyranny Of Launch" With In-space Manufacturing

[Ars Technica](#) (7/29) "Made in Space is one of the most intriguing companies in aerospace because it's not so much focused on getting into space. Rather, the company is focused on doing interesting, meaningful, and potentially profitable things once there. Its long-term goal is to build factories in space using additive manufacturing. A recent NASA contract, worth \$73.7 million, will allow Made in Space to significantly accelerate those efforts. 'For us, this is one of those watershed moments that take this technology and propel it into the next stage,' said Andrew Rush, president and chief executive officer, in an interview with Ars. Made in Space started the year with 40 employees and will end it with nearly 100."

Planet-Hunting Satellite TESS Finds 'Missing Link' Exoplanets

[CNN](#) (7/29, Strickland) "NASA's planet-hunting satellite TESS has discovered more than 20 exoplanets during its first year of observations, including some "missing link" planets entirely unlike anything in our own solar system."

After Years Of Sexism In Space We Urgently Need More Female Astronauts

[New Scientist](#) (7/24, Beall) "IN MARCH, the International Space Station was set to strike a blow for gender parity. NASA astronauts Anne McClain and Christina Koch were scheduled to perform the station's first all-women spacewalk, a mere 20 years and 214 spacewalks after the first pair of men stepped off the ISS into the starry darkness. In the end, the long-anticipated spacewalk didn't take place for an entirely trivial reason: the only spacesuit available for McClain to wear was a large, and she was a medium."

Most Federal Agencies Lack Cybersecurity Strategies, Says Report

[Washington Times](#) (7/29, Boylan) "Most federal agencies lack a cybersecurity risk management strategy program and are susceptible to "the loss of sensitive data or compromise of agency systems," according to a Government Accountability Office report. In an audit of 23 agencies, the government watchdog found that only seven had proper cybersecurity firewalls in place and many said the greatest challenge was finding personnel to develop them. ... The GAO noted comments

from NASA's chief cyber risk officer on the complexity of cybersecurity risk management — 'a multi-disciplinary field that blends technical cyber expertise with project management principles and a business-focused management background.'

Flight

No content.

Earth

NASA Tropical Storm Erick Strengthening

[Phys \(UK\)](#) (7/29) "Infrared imagery from NASA's Aqua satellite revealed a stronger Tropical Storm Erick in the Eastern Pacific Ocean. Satellite imagery revealed two areas of very cold cloud tops indicating powerful thunderstorms as the storm is on the cusp of hurricane status. Erick developed as Tropical Depression Six-E on Saturday, July 27, 2019. It formed about 1,215 miles (1,955 km) southwest of the southern tip of Baja California, Mexico. At 5:15 p.m. EDT that day, it strengthened into a tropical storm and was re-named Erick."

NASA Takes Tropical Storm Flossie's Temperature

[Phys \(UK\)](#) (7/29) "NASA's Aqua satellite took the temperature of Tropical Storm Flossie as it continued to strengthen and organize in the Eastern Pacific. Tropical Depression 7E formed in the Eastern Pacific Ocean on Sunday, July 28 about 580 miles (930 km) south-southwest of Manzanillo, Mexico. On July 29 at 5 a.m. EDT (0900 UTC), the depression strengthened into a tropical storm and was renamed Flossie."

Column: As The Arctic Warms, Wildfires Spread Toxic Air Pollution Far And Wide

[Buffalo \(NY\) News](#) (7/29) "The most visible symptom of runaway arctic warming is not rising sea levels – a topic for another article – but the huge number of wildfires now in progress. Wildfires during the arctic summer are not unusual. However, the intensity and number of wildfires this year is unprecedented in the instrumented era. Via the BBC, here is an image marking the fires from NASA polar orbiting satellites a little earlier this summer."

Changes In Earth's Gravity Field: Unique Data Series Will Be Continued

[Phys \(UK\)](#) (7/29) "The first gravity maps of the GRACE-FO mission are now available. The twin satellites of the GFZ German Research Centre for Geosciences and NASA continuously measure the Earth's gravitational field and thus carry on the successful GRACE mission. The acronym stands for Gravity Recovery And Climate Experiment. Groundbreaking results of the GRACE mission were, for example, observations of Greenland's ice mass loss. Previously, the amount of melting could only be estimated. GRACE flew from 2002 to 2017, in May 2018 GRACE-Follow On was launched into orbit. After switching on and extensive testing of the instruments in space, GRACE-FO data on monthly changes in the gravity field are now available to the scientific community worldwide."

NASA Tracks Wildfires From Above To Aid Firefighters Below

[Phys \(UK\)](#) (7/30) "Every evening from late spring to early fall, two planes lift off from airports in the western United States and fly through the sunset, each headed for an active wildfire, and then another, and another. From 10,000 feet above ground, the pilots can spot the glow of a fire, and occasionally the smoke enters the cabin, burning the eyes and throat."

Humans in Space

After Years Of Sexism In Space We Urgently Need More Female Astronauts

[New Scientist](#) (7/24, Beall) "IN MARCH, the International Space Station was set to strike a blow for gender parity. NASA astronauts Anne McClain and Christina Koch were scheduled to perform the station's first all-women spacewalk, a mere 20 years and 214 spacewalks after the first pair of men stepped off the ISS into the starry darkness. In the end, the long-anticipated spacewalk didn't take place for an entirely trivial reason: the only spacesuit available for McClain to wear was a large, and she was a medium."

NASA Wants To Grow Fruit In Space

[Fox News](#) (7/29, Ciaccia) "Even your snooty neighbor will be jealous of this fruit and vegetable garden. NASA is looking to grow a hybrid version of a New Mexico chile plant in space on the International Space Station as part of an experiment, starting in March 2020. A NASA group testing how to produce food beyond the Earth's atmosphere and the chile plant was created with input from Jacob Torres – an Española, N.M. native and NASA researcher."

Photos: SpaceX Completes Resupply Run To International Space Station

[Spaceflight Now](#) (7/29) "A SpaceX Dragon capsule packed with more than 5,000 pounds of hardware, provisions and experiments launched July 25 from Cape Canaveral and arrived at the International Space Station two days later. The Dragon spacecraft lifted off at 6:01:56 p.m. EDT (2201:56 GMT) July 25 on top of a Falcon 9 rocket from Cape Canaveral's Complex 40 launch pad."

Docking Mechanism, Other Dragon Cargo Arrives At ISS

[Aviation Week](#) (7/29) "SpaceX's 18th NASA-contracted Dragon resupply mission rendezvoused successfully with the International Space Station (ISS) July 27, maneuvering close enough for U.S. crew members Nick Hague and Christina Koch to command a grapple of the capsule and its 5,000-lb. cargo with the orbiting lab's 58-ft.-long Canadian robot arm at 9:11 a.m. EDT."

This Company Says It Has A Lunar Space Suit That Will Be Ready For NASA's 2024 Moon Mission

[The Verge](#) (7/29) "NASA is hyper focused on sending humans to the lunar surface by 2024, and those astronauts are going to need space suits to pull off the job – suits that the space agency currently doesn't have. Now one company, with decades of experience making space suits for NASA, says it has an ensemble that could be ready by the agency's ambitious deadline."

Moon to Mars

NASA Fed Some Of Its Precious Apollo 11 Lunar Samples To Cockroaches

[CNN](#) (7/29, Kim) "Scientists from NASA had a lot more leeway to conduct weird experiments 50 years ago, which included feeding moon dust to German cockroaches. But it didn't stop there. Astronauts Neil Armstrong and Buzz Aldrin were able to secure lunar samples from the surface of the moon from the Apollo 11 mission and bring them back to Earth. However, in order to ensure that it was safe to store lunar samples on Earth, scientists had to run a number of tests to make sure contamination was not possible, according to NASA."

NASA Fed Apollo 11 Moon Rocks To Cockroaches (And Then Things Got Even Weirder)

[LiveScience](#) (7/29) "It's too weird to make up: NASA fed some of its precious Apollo 11 lunar samples to cockroaches. And dumped it in fishbowls. And injected mice with it. No, really. NASA still has most of the moon rocks the Apollo 11 crew brought home, but a small fraction of the astronauts' bounty was used up in a little-known but vitally important set of experiments that

ensured lunar samples were safe to keep here on Earth."

Mysteries Of The Moon: What We Still Don't Know After Apollo

[Fox News](#) (7/27) "Astronaut Edwin (Buzz) Aldrin deploys two scientific experiments on the surface of the moon during Apollo 11. We visited the moon half a century ago, and have not been back since. During that time, we've launched robotic spacecraft across our solar system and learned about distant worlds. Meanwhile, scientists continue to ponder the rocky visitor to our night sky."

Bringing Pieces Of Mars To Earth In 2031: How NASA And Europe Plan To Do It

[SPACE](#) (7/29) "Pristine samples of the Red Planet will come down to Earth a little over a decade from now, if everything goes according to plan. NASA and the European Space Agency (ESA) are working together on a highly anticipated Mars sample-return mission, which advocates say is the logical next step in our study of the Red Planet and its life-hosting potential."

Historian Unveils Never-Seen Footage Of Armstrong And Aldrin On The Moon

[Air & Space Smithsonian Magazine](#) (7/29, Reichhardt) "One last Apollo story, if you haven't had your fill. And this is a good one. Back in May, in preparation for the upcoming 50th anniversary celebrations of Apollo 11, space historian Robert Godwin was going through film footage he'd received from NASA years earlier. One particular sequence caught his eye in a copy of the internegative created in July 1969 from the original 16 mm film returned from the moon."

NASA Outlines Plans For Lunar Lander Development Through Commercial Partnerships

[SPACE](#) (7/28) "As NASA celebrated the 50th anniversary of the first crewed landing on the moon, the agency released new details about how it will procure landers to enable humans to return to the moon in the 2020s. NASA released July 19 a presolicitation notice for its Human Landing System Integrated Lander effort, part of the Next Space Technologies for Exploration Partnerships (NextSTEP) program. The notice included a draft version of a broad agency announcement, with NASA requesting industry comments on it by Aug. 2."

Commercial Lunar Lander Company Terminates NASA Contract

[Space News](#) (7/29) "One of the three companies NASA selected less than two months ago to carry payloads to the moon has informed the agency it won't be able to perform that mission and has terminated its nearly \$100 million contract. NASA announced July 29 that OrbitBeyond informed the agency that "internal corporate challenges" will prevent it from carrying out a task order that NASA awarded the company May 31 as part of its Commercial Lunar Payload Services (CLPS) program. The company asked to be released from that contract, and NASA agreed."

NASA's Mars 2020 Rover Does Biceps Curls

[Phys \(UK\)](#) (7/29) "The robotic arm on NASA's Mars 2020 rover does not have deltoids, triceps or biceps, but it can still curl heavy weights with the best. In this time-lapse video, taken July 19, 2019, in the clean room of the Spacecraft Assembly Facility at the Jet Propulsion Laboratory in Pasadena, California, the rover's 7-foot-long (2.1-meter-long) arm handily maneuvers 88 pounds' (40 kilograms') worth of sensor-laden turret as it moves from a deployed to a stowed configuration."

NASA's Mars 2020 Rover Is Already Getting A Workout Without Leaving Earth

[BGR](#) (7/30, Wehner) "When NASA's Mars 2020 mission finally gets underway about a year from now it'll have been a long time coming. The mission has been in the works for years, and the ultra-high-tech rover will have plenty of work to do once it lands on Mars in early 2021, but it turns out the fancy robot doesn't even have to leave Earth to begin pulling its weight."

This Apollo 11 Experiment Is Still Happening On The Moon

[CNN](#) (7/29, Strickland) "When astronauts Neil Armstrong and Buzz Aldrin walked on the surface of the moon 50 years ago, they took photos, collected lunar rock samples and left behind an experiment that's still sending back data. Aldrin placed an array – an arrangement of 100 quartz glass prisms in rows – on the surface. Later, the Apollo 14 and 15 missions would also add similar arrays to the surface."

Solar System and Beyond

TESS Successfully Completes First Year Of Science Operations

[Sci-News](#) (7/29) "NASA's Transiting Exoplanets Survey Satellite (TESS) has discovered over two dozen extrasolar planets and captured data on other astronomical events (flare stars, eclipsing binaries, comets, asteroids, white dwarfs and supernovae) occurring in the southern sky during its first year of science operations."

NASA TESS Mission Completes Its First Year Of Scanning The Sky

[SlashGear](#) (7/29) "NASA has announced that the TESS (Transitioning Exoplanet Survey Satellite) mission has completed its first 12 months of surveying the skies. During its first year, TESS has discovered 21 planets outside of our solar system. TESS has also captured data on other interesting events in the southern sky. TESS started hunting for exoplanets in the southern sky in July of 2018. It has also collected data on supernovae, black holes, and other phenomena in its line of sight."

Planet-Hunting Satellite TESS Finds 'Missing Link' Exoplanets

[CNN](#) (7/29, Strickland) "NASA's planet-hunting satellite TESS has discovered more than 20 exoplanets during its first year of observations, including some "missing link" planets entirely unlike anything in our own solar system."

NASA's Planet-Hunting Satellite Discovers 'Rare' New World

[U.S. News & World Report](#) (7/29) "One of the planets is rocky and slightly larger than Earth, and the other two are gaseous and roughly double Earth's size, according to a study published Monday in the journal *Nature Astronomy* that details the discovery. One of the planets, that the satellite discovered, is rocky and slightly larger than Earth, and the other two planets are gaseous and roughly double Earth's size, according to a study. NASA's world-hunting satellite, the Transiting Exoplanet Survey Satellite, or TESS, has found three of the smallest, nearest planets outside of Earth's solar system."

NASA's Newest Planet-hunting Telescope Just Discovered A 'Super-Earth' And 2 'Sub-Neptunes' Less Than 75 Light-years Away

[Business Insider India](#) (7/29) "Three newly discovered worlds are among the smallest and nearest we've ever detected. NASA's Transiting Exoplanet Survey Satellite (TESS) – a super-powerful orbiting telescope designed to hunt for alien worlds – found the planets orbiting a star just 73 light-years away."

Distant Alien Planet With Three Red Suns Discovered

[Fox News](#) (7/29, Rogers) "Imagine living in a world of triple sunsets. Scientists have used NASA's Transiting Exoplanet Survey Satellite to find an exoplanet with three red suns. The exoplanet LTT 1445Ab orbits one of the three suns, all of which are described as mid-to-late-life red dwarfs. 'The planet transits the primary star in the system,' researchers explain, in a paper which is available

on the scientific repository arXiv."

NASA Telescope Discovers Three Intriguing Planets Hiding Around Nearby Star

[CNET News](#) (7/29, Kooser) "NASA's Transiting Exoplanet Survey Satellite (TESS) just scored another science triumph with the discovery of three fascinating planets hanging out at a nearby star. One is a super-Earth, slightly bigger than our own planet. The other two are Neptune-like exoplanets, the likes of which you won't find in our own solar system."

New Young Gas-giant Planet Discovered By Nasa's TESS Satellite

[BBC News Online \(UK\)](#) (7/29) "A new planet has been discovered by Nasa's TESS satellite. The planet is located around 151 light years away in the Toucana (or Toucan) constellation. It's nearly six times the size of Earth, and is bigger than Neptune, but smaller than Saturn."

NASA's TESS Mission Finds Three Nearby 'oven-hot' Exoplanets

[SlashGear](#) (7/29) "NASA has announced that its Transiting Exoplanet Survey Satellite, more commonly called TESS, has discovered three new Earth-like planets. All three exoplanets are orbiting a nearby star, according to the space agency, which reports that two of the celestial bodies are not the type of planet found in our own solar system. The third exoplanet is described as 'slightly larger than Earth.'"

NASA's TESS Satellite Spots 'Missing Link' Exoplanets

[New York Times](#) (7/29, Overbye) "Halfway through its first tour of the local universe, the spacecraft has found a 'Super Earth' and two 'sub-Neptunes.' NASA's new planet-hunting spacecraft, the Transiting Exoplanet Survey Satellite, is now halfway through its first tour of the nearby universe. It has been looking for worlds that might be fit for you, me or some other form of life, and as usual, nature has been generous in its rewards."

NASA's TESS Discovers 'Super-Earth' and Two Other Exoplanets Just 73 Light Years Away

[Newsweek](#) (7/29) "A 'super-Earth' and two other exoplanets have been discovered by NASA's Transiting Exoplanet Survey Satellite (TESS) orbiting a star that's located just 73 light years from our planet. The three planets are among the smallest and closest exoplanets found to date, according to a team of astronomers led by Maximilian Günther, from MIT's Kavli Institute for Astrophysics and Space Research."

NASA's TESS Telescope Spots 2 'Missing Link' Exoplanets (and A Super Earth, Too!)

[SPACE](#) (7/29) "NASA's newest planet hunter has bagged three more trophies, two of which may help scientists better understand how worlds form and evolve. The Transiting Exoplanet Survey Satellite (TESS) has spotted three planets orbiting the red dwarf star TOI-270, which lies just 73 light-years from the sun, a new study reports. All three worlds are relatively small. One is a rocky 'super-Earth' not much bigger than our own planet, and the other two are 'sub-Neptunes' about half the size of our solar system's other blue planet, researchers said."

NASA Discovers Three New Planets Nearby

[Daily Mirror \(UK\)](#) (7/29, Harris) "Scientists say they have discovered three new planets outside our solar system which orbit a star situated 73 light years away from Earth. The trio are among the smallest and nearest exoplanets known to date, using Nasa's Transiting Exoplanet Survey Satellite (TESS), which was sent into space in 2018 with the aim of finding new worlds around neighboring stars that could support life."

NASA's Newest Planet-hunting Telescope Just Discovered A 'Super-Earth' And 2 'Sub-

Neptunes' Less Than 75 Light-years Away – Among The Closest Exoplanets Ever Found

[Business Insider](#) (7/29, McFall-Johnsen) "Three newly discovered worlds are among the smallest and nearest we've ever detected. NASA's Transiting Exoplanet Survey Satellite, or TESS – a super-powerful orbiting telescope designed to hunt for alien worlds – found the planets orbiting a star just 73 light-years away."

NASA Planet Hunter Spots Intriguing Trio Around Nearby Star

[CNET News](#) (7/29, Kooser) "NASA's Transiting Exoplanet Survey Satellite (TESS) just scored another science triumph with the discovery of three fascinating planets hanging out at a nearby star. One is a super-Earth, slightly bigger than our own planet. The other two are Neptune-like exoplanets, the likes of which you won't find in our own solar system. The star is known as 'TESS Object of Interest 270,' or TOI 270 for short. Its more formal name is 'UCAC4 191-004642,' but that's a mouthful. The star is 40% smaller than our sun and is also about a third cooler. It hangs out 73 light-years away, which qualifies it as a neighbor."

NASA's TESS Mission Finds 'Missing Link' Planets

[Phys \(UK\)](#) (7/29) "NASA's newest planet-hunting satellite has discovered a type of planet missing from our own solar system. Launched in 2018, the Transiting Exoplanet Survey Satellite, or TESS, has found three new worlds around a neighboring star. Stephen Kane, a UC Riverside associate professor of planetary astrophysics, says the new star system, called TESS Object of Interest, or TOI-270, is exactly what the satellite was designed to find."

NASA's TESS Mission Finds 'Missing Link' Planets

[Astrobiology Magazine](#) (7/29) "Launched in 2018, the Transiting Exoplanet Survey Satellite, or TESS, has found three new worlds around a neighboring star. Stephen Kane, a UC Riverside associate professor of planetary astrophysics, says the new star system, called TESS Object of Interest, or TOI-270, is exactly what the satellite was designed to find."

Three Newly Discovered Exoplanets Orbit A Star 73 Light Years Away

[New Scientist](#) (7/29) "Three new planets, which orbit a star situated 73 light years away from Earth, have been found. The trio are among the smallest and nearest exoplanets known to date. Within the system known as TOI-270 there is a rocky planet that is slightly larger than Earth, as well as two gaseous planets roughly twice Earth's size. While the temperature range at the very top of the furthest planet could support some forms of life, the atmosphere itself is probably too thick and dense, creating an intense greenhouse effect making it an unlikely host for water and life."

TESS Discovers Three New Planets Nearby, Including Temperate 'Sub-Neptune': Planetary System Orbiting An Unusually Quiet Star Is Ideal For Future Habitability Searches

[Science Daily](#) (7/29) "NASA's Transiting Exoplanet Survey Satellite, or TESS, has discovered three new worlds that are among the smallest, nearest exoplanets known to date. The planets orbit a star just 73 light years away and include a small, rocky super-Earth and two sub-Neptunes – planets about half the size of our own icy giant. The sub-Neptune furthest out from the star appears to be within a 'temperate' zone, meaning that the very top of the planet's atmosphere is within a temperature range that could support some forms of life. However, scientists say the planet's atmosphere is likely a thick, ultradense heat trap that renders the planet's surface too hot to host water or life."

How Salts On The Surface Could Aid In Modeling Europa's Ocean

[Astrobiology Magazine](#) (7/29) "Even though there are planned missions to explore Jupiter's moon

Europa, they are unlikely to sample the depths of its potentially habitable ocean. So a new paper, published in the journal *Icarus*, lays out how we may be able to probe those deep waters from their expression on the surface. ... Most of what we know about the moon is thanks to NASA's Galileo mission, which launched in 1989 and found evidence for Europa's salty oceans. To date, no mission has landed on the moon."

Gravitational Waves Could Guide Space 'Hitchhikers' To A Magrathea-Like World

[SPACE](#) (7/29) "A future European mission could use gravitational waves to detect planets straight out of the beloved science-fiction novel "The Hitchhiker's Guide to the Galaxy," according to a new paper. In the past few years, gravitational waves have probed the pairs of black holes. Soon, they may also reveal planets that orbit pairs of white dwarfs, stars at the end of their lifetimes."

How Astronomers Missed The Huge Asteroid That Just Flew Unexpectedly By Earth

[NBC News](#) (7/29) "A large asteroid just whizzed past our planet – and astronomers weren't expecting it. Ranging in size from 187 to 427 feet (57 to 130 meters) wide, the space rock named 2019 OK snuck up on us Thursday morning (July 25). It swung as close as 45,000 miles (73,000 kilometers) from Earth, what one astronomer told The Washington Post was 'uncomfortably close.' ... Astronomers around the world continue to work to monitor any asteroids that pose danger to us. Several ongoing large-sky surveys to track near-Earth asteroids. For example, NASA is tracking over 90 percent of the asteroids that are 0.62 miles (1 km) or larger and are orbiting close to our planet, according to NASA's Jet Propulsion Laboratory."

Hubble Space Telescope Sees NGC 3432: Edge-On And Distorted

[Sci-News](#) (7/29) "The NASA/ESA Hubble Space Telescope has captured a striking new photo of the edge-on spiral galaxy NGC 3432. Visible in the constellation of Leo Minor, NGC 3432 is located some 45 million light-years away from Earth. Also known as LEDA 32643 and UGC 5986, the galaxy was discovered by British astronomer William Herschel on March 19, 1787."

After Moon Landing Anniversary, NASA Aims Beyond Earth Orbit

[Voice of America](#) (7/22) "What looks like an unusual giant orange metal canister, rising high above the windy and humid Alabama landscape, has some familiar design features. 'There's a lot of heritage shuttle technology here,' said NASA engineer Mike Nichols. But this canister is not intended to return the iconic fixed-wing, reusable space shuttle back into orbit, which was retired in 2011 – the last time NASA sent an astronaut into space from U.S. soil."

Space Tech

NASA's New Lightweight X-ray Mirrors Ready For Try-outs In Space

[Phys \(UK\)](#) (7/29) "Recent testing has shown that super-thin, lightweight X-ray mirrors made of a material commonly used to make computer chips can meet the stringent imaging requirements of next-generation X-ray observatories. As a result, the X-ray mirror technology being developed by Will Zhang and his team at NASA's Goddard Space Flight Center in Greenbelt, Maryland, has been baselined for the Design Reference Mission of the conceptual Lynx X-ray Observatory—one of four potential missions that scientists have vetted as worthy pursuits under the 2020 Decadal Survey for Astrophysics."

NASA Seeks To Break The "Tyranny Of Launch" With In-space Manufacturing

[Ars Technica](#) (7/29) "Made in Space is one of the most intriguing companies in aerospace because it's not so much focused on getting into space. Rather, the company is focused on doing interesting, meaningful, and potentially profitable things once there. Its long-term goal is to build

factories in space using additive manufacturing. A recent NASA contract, worth \$73.7 million, will allow Made In Space to significantly accelerate those efforts. 'For us, this is one of those watershed moments that take this technology and propel it into the next stage,' said Andrew Rush, president and chief executive officer, in an interview with Ars. Made in Space started the year with 40 employees and will end it with nearly 100."

Various

Most Federal Agencies Lack Cybersecurity Strategies, Says Report

[Washington Times](#) (7/29, Boylan) "Most federal agencies lack a cybersecurity risk management strategy program and are susceptible to "the loss of sensitive data or compromise of agency systems," according to a Government Accountability Office report. In an audit of 23 agencies, the government watchdog found that only seven had proper cybersecurity firewalls in place and many said the greatest challenge was finding personnel to develop them. ... The GAO noted comments from NASA's chief cyber risk officer on the complexity of cybersecurity risk management – 'a multi-disciplinary field that blends technical cyber expertise with project management principles and a business-focused management background.'"

Other

JAXA To Launch Eighth HTV Space Station Cargo Mission In September

[Spaceflight Now](#) (7/29) "Japan's eighth resupply mission to the International Space Station is set for liftoff Sept. 10 with another batch of upgraded batteries, crew provisions and experiments for the orbiting research lab, the country's space agency announced Monday. The eighth H-2 Transfer Vehicle will blast off on top of an H-2B rocket from the Tanegashima Space Center, located on Tanegashima Island near the southwestern extent of Japan's main islands."

Watch Japan's Hayabusa2 Wild Smash And Grab Landing On Asteroid Ryugu

[CNET News](#) (7/29, Serrels) "Earlier this month, July 10, the Hayabusa2 spacecraft touched down briefly on asteroid Ryugu to collect samples to take back to Earth. The robotic explorer is making quite a name for itself on Ryugu and, thanks to a public donation, its fitted with a camera that lets us Earthlings experience exactly what it experiences. On Friday, the Japan Aerospace Exploration Agency (JAXA) released new footage of Hayabusa's smash and grab giving up a close up of the historic touchdown."

Elon Musk Says A SpaceX Starship Design Update Is Coming In Mid-August

[SPACE](#) (7/29) "We won't have to wait much longer for our next update about SpaceX's Mars-colonizing spaceship, which the company calls Starship. SpaceX founder and CEO Elon Musk had promised that he'd unveil the latest Starship design changes after the vehicle's stubby test-flight prototype, known as Starhopper, completed its first untethered hop."

Elon Musk Drops Fresh Update On SpaceX's Mission To Mars

[Daily Express \(UK\)](#) (7/29, McGleenon) "The billionaire entrepreneur wrote on Twitter: 'Now that Hopper has flown, Starship update probably in two weeks or so.' That milestone occurred last week at SpaceX's South Texas facility in Boca Chica, so the update will be coming soon, probably by mid-August, Musk said over the weekend. Musk first outlined a detailed Starship design in September 2016, during a talk at the annual International Astronautical Congress (IAC) in Mexico."

platforms and additional forms of open-source data. Sources for Bulletin Intelligence audience-size estimates include Scarborough, GfK MRI, comScore, Nielsen, and the Audit Bureau of Circulation. Data from and access to third party social media platforms, including but not limited to Facebook, Twitter, Instagram and others, is subject to the respective platform's terms of use. Services that include Factiva content are governed by Factiva's [terms of use](#). Services including embedded Tweets are also subject to [Twitter for Website's information and privacy policies](#). The NASA Morning Briefing is published five days a week by Bulletin Intelligence, which creates custom briefings for government and corporate leaders. We can be found on the Web at [BulletinIntelligence.com](#), or called at (703) 483-6100.

From: Johnson, Lindley (HO-DG000)
To: Fast, Kelly E. (HO-DG000)
Subject: Re: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize
Date: Friday, July 26, 2019 8:40:04 AM

This is sort of why I've taken to only showing the 140 meter and larger chart many times. That is what GPRA is judging us on anyway. But, that leads to ignoring the smaller but still dangerous objects.

Maybe we need a 50 meter and larger discovery chart too.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Fri, July 26, 2019 8:18 AM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov> [REDACTED]
<[REDACTED]>, <[REDACTED]> <[REDACTED]>
Subject: Re: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

We're a part of promoting that since we always show the discovery stats. And Catalina can always looks good that way, for instance, but not so good on the 140m plot as a result (actually not so good on either plot this year). We might need some other quality-not-quantity metric that's easy to display and easy for folks like mgmt and congress people understand, in order to encourage different survey modes. These are different surveys with different strengths and different purposes, and it would be good to find a way to encourage them to fully explore those strengths rather than unwittingly encouraging them to play to the "All" bar chart.

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: Lindley Johnson <lindley.johnson@nasa.gov>
Date: Friday, July 26, 2019 at 8:09 AM
To: Kelly Fast <kelly.e.fast@nasa.gov>, Tim Spahr <tspahr44@gmail.com>, James Bauer <gerbsbauer@gmail.com>
Subject: Re: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

Not really instinct. I just looked at the obs submitted on the MPEC.

But what im really wondering is that in an effort to build up their discovery counts, i.e. go for smaller and therefore usually faster moving objects, the surveys are leaving open a corner of the larger objects, albeit while still faint and slow moving.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Fri, July 26, 2019 7:54 AM -0400
To: **b6** <**b6**>, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>,
b6 <**b6**>
Subject: Re: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

Wow, not the answer I what I was expecting, but I don't have Lindley's instincts! Thanks so much, **b6**, this is really fascinating. And a tough issue since I'm guessing it must be difficult to go after slow objects and not pick up more false detections and to also disentangle them from TNOs.

- - - - -

Dr. Kelly Elizabeth Fast
[Near-Earth Object Observations](#) Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: **b6** <**b6**>
Date: Thursday, July 25, 2019 at 9:13 PM
To: Lindley Johnson <lindley.johnson@nasa.gov>, Kelly Fast <kelly.e.fast@nasa.gov>, **b6** <**b6**>
Subject: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

Hi all, I got comments back from **b6**. Pan-Starrs missed 2019 OK because it was too faint in June, and too slow in July. It was actually in the clear in the frames in each month (all 4 frames) so it theoretically could have been detected.

I must compliment Lindley on his instincts here. There is a spectacularly important lesson here-- ATLAS and to a lesser extent Pan-STARRS need to detect slower objects. The raison d'etre for ATLAS is detecting imminent impactors. It looks like some impactors are too slow to be found easily. It is fairly disturbing to me that this object was undetectably slow for nearly 2 weeks! Fascinating stuff.

So the executive summary: the object was missed because it was too faint in June, and too slow to detect in July until right before the close approach.

Hope this helps--if you need anything else let me know!

DD

From: [Fast, Kelly E. \(HO-DG000\)](#)
To: [\[REDACTED\]](#)
Cc: [\[REDACTED\]](#); [\[REDACTED\]](#) Johnson, Lindley (HO-DG000)
Subject: Re: [EXTERNAL] Re: Impact due to Maunakea shutdown
Date: Tuesday, July 30, 2019 6:25:22 PM

Thanks [REDACTED] and everyone for your roll up. The big-picture summary at the end is really helpful and that's what I should have asked for. It will be helpful for our tracking. Thanks also for the info on 2019 OK. Very interesting.

Kelly

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: [\[REDACTED\]](#) <[\[REDACTED\]](#) edu>
Date: Tuesday, July 30, 2019 at 6:07 PM
To: Kelly Fast <kelly.e.fast@nasa.gov>
Cc: [\[REDACTED\]](#) <[\[REDACTED\]](#).edu>, [\[REDACTED\]](#) [\[REDACTED\]](#) du>
Subject: [EXTERNAL] Re: Impact due to Maunakea shutdown

Hi Kelly:

It is a little tricky to reconstruct what we would have targeted with CFHT, but we can log it going forward. Note also that CFHT's crane is broken - so Megacam was stuck on the telescope, and available right through full moon.

We would have obtained two more sets of observations of 2019 OK as it was outbound, which likely would have been important for the orbit. Note also that [REDACTED] and [REDACTED] have found some archival observations from PS and DECAM from two years ago - these were submitted yesterday to the MPC, but MPC has not yet issued an MPEC.

We typically observe 12-14 objects per night with CFHT.

The PS objects on the NEOCP that are likely to be lost due to inability to use CFHT are:

P10Q3Du
P10PQSN
P20Q5dJ
P10PQSO

P10Q1DK
P10PPTW
P20Q8In
P20Q1DM
P10Q3Dx
P10PW8I
P10Q6kt
P10Q8di
P20Q5VZ
P10PRn9
P10Q7hw
P10PRn7
P20Q4xs
P10Q0Ee
P10PQRK
P10QaU4
P10Q7h8
P10Q3fR
P20QcrQ
P10Q7h7

That is a total of 24 objects with positional uncertainty > 5 arc minutes. There are about 40 more with smaller uncertainties that will grow if not recovered soon.

We will certainly try to recover some of these via regular survey fields, but note that there are two hurricanes to the east, so weather may start to become poor closer to the weekend.

Please let me know if this is close enough to what you need right now.

Thanks,



On Tue, Jul 30, 2019 at 6:28 AM Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov> wrote:

Hi 

If this is not a complicated request, would you please send me a list of your follow-up targets that were not observed due to the shutdown on Maunakea, and flag anything that was particularly critical? We need to track and report the impacts here for NASA-funded work. It will be general, just noting objects not followed-up, without calling out Pan-STARRS.

Thanks so much,
Kelly

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
Planetary Defense Coordination Office
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: Johnson, Lindley (HQ-DG000)
To: 
Cc: Andrews, Victoria Pidgeon (HQ-CO000)
Subject: RE: [EXTERNAL] RE: Space Stuff and Asteroid 2019 OK
Date: Monday, July 29, 2019 12:06:00 PM
Attachments: [2019 OK NASA Close Approach Notification v2.docx](#)
Importance: High

 – Here is some more info on 2019 OK.

Sorry I did not get to you sooner.

Lindley

Lindley N. Johnson
Planetary Defense Officer
Planetary Science Division
Science Mission Directorate
HQ NASA
202 358-2314
Lindley.Johnson@nasa.gov

Hic Servare Diem

See Planetary Defense at NASA: <http://www.nasa.gov/planetarydefense/overview>

From:   >
Sent: Sunday, July 28, 2019 10:38 PM
To: Johnson, Lindley (HQ-DG000) <Lindley.Johnson@nasa.gov>
Subject: RE: [EXTERNAL] RE: Space Stuff and Asteroid 2019 OK

Lindley, Thank you, you guys are making me really learn this stuff. I did not think that Post article was correct. Standing by, I can calm anyone down tomorrow.

v/r



From: Johnson, Lindley (HQ-DG000) <Lindley.Johnson@nasa.gov>
Sent: Sunday, July 28, 2019 1:45 PM
To:   >
Subject: RE: [EXTERNAL] RE: Space Stuff and Asteroid 2019 OK

 I just got to airport to fly to Houston today. I should have some time once settled on flight to pull some good information together for you. There is a lot of bad information in the WP story. We're trying to get our OCOMMS to ask them to correct some things.

Bottomline: this was a very significant close approach by a sizable object that wasnt detected until

the last day or so. The story of the limitations to detect 2019 OK is not OK.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From:  "  >
Date: Sun, July 28, 2019 12:58 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
CC: "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Subject: RE: [EXTERNAL] RE: Space Stuff and Asteroid 2019 OK

https://www.washingtonpost.com/nation/2019/07/26/it-snuck-up-us-city-killer-asteroid-just-missed-earth-scientists-almost-didnt-detect-it-time/?utm_source=pocket-newtab&utm_term=.6ffb1359bc7e

From:  
Sent: Sunday, July 28, 2019 12:14 PM
To: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>
Cc: Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>; Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov>
Subject: RE: [EXTERNAL] RE: Space Stuff and Asteroid 2019 OK

Lindley,
Thank you, I will attempt to modify my schedule on Monday. I have a series of meeting with the DHS Ops staff and my FEMA leadership on Monday. Can your team provide me with anything substantiive for the flyby of Asteroid 2019 OK yesterday? I am including the article from the Washington Post, but I would like to make sure I say the right things tomorrow. By the way, if we had a space based system like NEOCam on orbit, would we have detected that object even though according to the article the orbit was very eccentric? I am sure a few folks might ask me a question or two tomorrow. Hope everyone had a pleasant weekend.

V/r

From: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>
Sent: Friday, July 26, 2019 5:40 PM
To:  < >
Cc: Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>; Fast, Kelly E. (HQ-

DG000) <kelly.e.fast@nasa.gov>

Subject: Re: [EXTERNAL] RE: Space Stuff,

The SBIRNSS (aka NEOCam) meeting wont be until November.

The IAWN and SMPAG Meetings are scheduled for 12 and 13 Sep in Garching, GE, near Munich. This is the endorsement of the week before the ESA exercise, so it would be convenient for you to attend.

Kelly can forward the logistics information to you.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "DG" <kelly.e.fast@nasa.gov>

Date: Fri, July 26, 2019 10:17 AM -0400

To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>

Subject: [EXTERNAL] RE: Space Stuff,

Lindley, Victoria,

Have you guys schedules the NEOCam or IAWN meetings yet ? Today might be my last chance to grab travel money before the sweep. I am good to go for the ESA trip in September.

v/r



From: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>

Sent: Monday, April 29, 2019 12:32 PM

To:  <kelly.e.fast@nasa.gov>

Subject: RE: Space Stuff,

The IAWN and SMPAG meetings are about 12-13 Sept near Munich, GER.

The NEOCam meeting is not yet scheduled but will probably be in August at JPL.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "b6 [REDACTED]" <b6 [REDACTED]>
Date: Mon, April 29, 2019 12:24 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Andrews, Victoria Pidgeon (HQ-CQ000)" <victoria.p.andrews@nasa.gov>
Subject: RE: Space Stuff,

Lindley,
Do you have actual dates for any of the above, I am going to submit for the IAWN and NEOCam Review. We will see which one goes through. I am getting my official passport renewed now.
Thanks
v/r
b6 [REDACTED]

From: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>
Sent: Friday, April 26, 2019 1:23 PM
To: b6 [REDACTED] <b6 [REDACTED]>; Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>
Subject: RE: Space Stuff,

IAWN and SMPAG meetings in Munich in September.

Maybe a NEOCam milestone review in August at JPL.

Lindley

Lindley N. Johnson
Planetary Defense Officer
Planetary Science Division
Science Mission Directorate
HQ NASA

202 358-2314
Lindley.Johnson@nasa.gov

Hic Servare Diem

See Planetary Defense at NASA: <http://www.nasa.gov/planetarydefense/overview>

From: b6 [REDACTED] <b6 [REDACTED]>
Sent: Friday, April 26, 2019 1:11 PM
To: Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov>; Andrews, Victoria Pidgeon (HQ-CQ000) <victoria.p.andrews@nasa.gov>
Subject: Space Stuff,

Lindley, Victoria,

Are there any space related events, that I might be interested in attending later in the year. I have access to some travel funds and I don't want to give them up. If you think there is something that might help me help you let me know.

v/r

[REDACTED]

b6 [REDACTED]

Response Operations
Federal Emergency Management Agency
FEMA Rep b6 [REDACTED]
Phone: b6 [REDACTED]
BB: b6 [REDACTED]
Email DHS b6 [REDACTED]
[REDACTED]
[REDACTED]
[REDACTED]



Asteroid 2019 OK Passed Close By Earth 24 July 2019

DETAILS:

Close Approach Date/Time: 25 July 2019, 01:22 UTC (24 July 21:22 EDT)

Close Approach Distance: approximately 48,000 miles (77,000 km)

Approximate Diameter: 180-430 feet (50-130 meters) in diameter

Impact Probability for this Approach: None

The NASA Planetary Defense Coordination Office advises that an asteroid designated 2019 OK safely passed Earth at a distance from its surface of about 45,000 miles (74,000 kilometers), approximately 1/5th the distance from the Earth to the Moon, at 9:22 pm EDT on Wednesday, 24 July 2019. Although small asteroids come between Earth and Moon almost weekly, this object – estimated at between 180 and 430 feet (50 and 130 meters) in size – is unusually large for such a close pass and thus has generated media and public attention.

Asteroid 2019 OK was originally discovered in the evening of July 23rd by SONEAR (Southern Observatory for Near-Earth Asteroids Research), a Brazilian team of asteroid observers, about 24 hours before closest approach. Once follow up observations were obtained by other observatories that evening, “pre-covery” observations were obtained by the NASA-funded Pan-STARRS and ATLAS observatories as far back as 28 June that allowed the orbit to be refined and confirmed the very close approach on the evening of the 24th. This is the closest approach known by an object this size in the last century, and the closest predicted until the close approach of Apophis in April 2029.

NASA has detected less than 25% of the predicted population of near-Earth asteroids of this size range. Detection of 2019 OK was complicated by the fact that it is on a highly elliptical orbit and appeared to not be moving on the plane of sky because of the geometry of the orbit relative to Earth for much of the month prior to the close approach; the complication of a very dim object in a crowded field of stars and the lack of motion made it much harder to detect and calculate an orbit until it was quite close.

2019 OK is now inbound to perihelion and will then travel on its orbit to beyond the orbit of Mars before turning back toward the Sun. It will not pass close by Earth again until the next century, and no additional passes within the Moon’s orbit are currently predicted.

This notification is provided in compliance with NASA Policy Directive (NPD) 8740.1 - *Notification and Communications Regarding Potential Near-Earth Object Threats*. While this object does not present an impact hazard at this time, it passed sufficiently close to garner interest by the media and others.

Further information about 2019 OK can be found on the JPL Center for Near-Earth Object Studies (CNEOS) webpage at <https://ssd.jpl.nasa.gov/sbdb.cgi?sstr=2019%20OK1>. For additional information about NASA’s Planetary Defense Coordination Office: www.nasa.gov/planetarydefense.

From: [Fast, Kelly E. \(HO-DG000\)](#)
To: 
Cc: [Johnson, Lindley \(HQ-DG000\)](#);  (HO-DG000)[NATIONAL INSTITUTE OF AEROSPACE]; [Chodas, Paul W \(JPL-4085\)](#) [Jet Propulsion Laboratory]; [Johnson, Alana R. \(HQ-NG000\)](#) [InuTeq, LLC]
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story
Date: Saturday, July 27, 2019 2:28:43 PM

Well, here's someone from the American Museum of Natural History yesterday who even knows about the Congressional direction, but he uses the royal "we," he doesn't say the direction was given to NASA, and he concludes that we don't know what to do if we do find one (no knowledge of DART or NASA work, or the U.S. Nat'l NEO Strategy and Action Plan). Can skip to 4:00:

<https://newyork.cbslocal.com/video/4132510-east-coast-fireball-explained/>

Although one problem is that the press doesn't ask NASA, it seems that a bigger problem is that the scientists the press consults don't know or communicate properly about NEOs and PD and they don't recognize their own shortcomings or refer to NASA where appropriate. Our journalist workshops help, but I think we need to fire Lindley and post his job to make national news (hey, it worked for planetary protection) and then he can do the morning show and talk show circuit once he is rehired! Seriously, we need a PD road show...

Dr. Kelly Elizabeth Fast
[Near-Earth Object Observations Program Manager](#)
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From:  
Date: Saturday, July 27, 2019 at 1:44 PM
To: Kelly Fast <kelly.e.fast@nasa.gov>
Cc: Lindley Johnson <lindley.johnson@nasa.gov>;  (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE] < "Chodas, Paul W (JPL-4085)" [Jet Propulsion Laboratory]> <paul.w.chodas@jpl.nasa.gov>; "Johnson, Alana R. (HQ-NG000)" [InuTeq, LLC] <alana.r.johnson@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

Hi Kelly, not dragging out. This one is necessary IMO.

The ASASSN guys have a long history with the MPC.  and I had to chew them out (in an MPEC no less) in their previous iteration for announcing--via the Astronomer's Telegram--an object for which they predicted a chelyabinsk-type impact. They were wrong. Their astrometry was really bad and when confirmed the object was .2 AU away or something. So it is no surprise they ignored NASA

and the MPC. At least not to me.

The full details on this object are scant. I can't tell who actually found it--I think I'll have to go to [REDACTED]. The discovery is currently SONEAR, who is applying for IAWN membership. But ASASSN folks apparently used two scopes at existing big telescope locations in the US but didn't use the right observatory codes. Ugh.

I know one of the goals of IAWN is to be the source for information. How do we do that when the press interviews random astronomer--or worse, Voldemort (let's not forget he was interviewed about NEOs on CNN...)?

[REDACTED]

On Sat, Jul 27, 2019 at 1:06 PM Fast, Kelly E. (HQ-DG000) <kelly.e.fast@nasa.gov> wrote:

So here's Popular Science, also not asking NASA or CNEOS, rattling off numbers without sources (and quotes from [REDACTED] and [REDACTED] are from other interviews):

<https://www.popsci.com/asteroid-close-earth-ok-2019/>

Sorry to drag out the conversation, but as I wonder why the media talk to the first person they find instead of NASA...

They do quote [REDACTED] who spoke with Public Radio International and who observed 2019 OK with the All-Sky Automated Survey for Supernovae (ASASSN). I don't see that ASASSN submitted 2019 OK observations to MPC, or even has an observatory code. Looking at their page <http://www.astronomy.ohio-state.edu/~assassin/index.shtml>

their telescopes are hosted on LCO sites, but LCO isn't listed as observing 2019 OK either. [REDACTED], does ASASSN submit to MPC and I missed it? They fancy themselves a "Small Synoptic Survey Telescope" complementing LSST by surveying shallow and often, sort of a supernova version of ATLAS, but they survey only to 18th magnitude (with quads of 14cm telescopes).

But if they're speaking on the radio about observing NEOs with their survey, they should either get more background or refer to NASA. At least the [REDACTED] did say that \$1B/yr should go to NEO work, ha! I gave a PD talk at [REDACTED] a few years ago when [REDACTED] was a [REDACTED] undergrad there, but it was in the School of Earth Sciences, not the Astronomy Dept.

Kelly

[REDACTED]

Dr. Kelly Elizabeth Fast

Near-Earth Object Observations Program Manager

Planetary Defense Coordination Office
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: [REDACTED] [REDACTED]
Date: Saturday, July 27, 2019 at 10:26 AM
To: Lindley Johnson <lindley.johnson@nasa.gov>
Cc: [REDACTED] (HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE]"
[REDACTED] Kelly Fast <kelly.e.fast@nasa.gov>, "Chodas, Paul W (JPL-4085)
[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>, "Johnson, Alana R. (HQ-NG000)
[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Subject: Re: [EXTERNAL] Re: Unhappy about Washington Post story

AMEN to that... let's not forget they have periodically had good advocates and even programs, and shut them down...

[REDACTED]

On Sat, Jul 27, 2019 at 10:11 AM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

What makes this especially galling is that the Australian are doing essentially nothing to support Planetary Defense.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: [REDACTED] <[\[REDACTED\]](mailto:[REDACTED])>
Date: Sat, July 27, 2019 9:55 AM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
CC: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>, "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>, "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "EXTERNAL" [REDACTED] [REDACTED]
Subject: [EXTERNAL] Re: Unhappy about Washington Post story

See attached story from the Sydney (Australia) Morning Herald - perhaps where this thing

started, media-wise? It quotes the two Australian astronomers - anybody know them? If so, it might be helpful to ask them to think before they speak (of nuclear explosions and such...). I don't know whether the Sydney reporter reached out to them or whether they reached out to him. All the rest - including WaPo -- is simply repetition.

What this story says to me is that the detection and notification system worked perfectly, as usual. (For pete's sake, these stories used CNEOS's visuals!) If Alana reaches out, she might want to make this point.

This story also says to me that we have to keep up our good work of calming down asteroid rhetoric - city-killers, nukes, etc. I will reach out as well.

Paul, when you talk with NPR (is it Joe Palca?), I'm sure you'll make these points -- the system keeps working like it's supposed to, an asteroid can't be a "city killer" when it flies by Earth at 70,000 km, and if and when an asteroid impact might occur, it would not release any nuclear radiation. (Tim, no wonder you went ballistic when you saw this....)

Sigh...

Cheers,

b6
b7c

b6 Ph.D.
Consultant to NASA's Astrobiology Program and Planetary Defense Coordination Office
National Institute of Aerospace
ph. b6 , b6 (mobile)
b6

On Fri, Jul 26, 2019 at 10:48 PM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

As Kelly says, I think this is lazy journalism.

I dont recognize the name of the reporter. Not one of the usual WP science reporters.

I've copied Alana. Maybe NASA OCOMMS can suggest to WP "WTF, over".

Lindley

Lindley N Johnson

Planetary Defense Officer HQ NASA

----- Original Message -----

From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Fri, July 26, 2019 9:11 PM -0400
To: "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>,
"Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
CC: "EXTERNAL-[REDACTED]" <[\[REDACTED\]](mailto:[REDACTED])> [REDACTED] "DG-[REDACTED]" <[\[REDACTED\]](mailto:[REDACTED])> (HQ-
DG000)[NATIONAL INSTITUTE OF AEROSPACE]" <[\[REDACTED\]](mailto:[REDACTED])>
Subject: Re: Unhappy about Washington Post story

Hi Paul,

I hadn't seen this one, but I saw these names in earlier articles elsewhere, so I think it's just the usual lazy journalism where reporters report on and follow up other reporter's reports. That's why the Washington Post is focusing on Australian scientists... they saw them in another article and didn't think about the fact that they're in Washington DC, and that NASA HQ is in Washington DC, hmmm....

Adding  here because she's great at being a third party and reminding reporters that it IS possible to reach directly out to NASA if they want the right information on what NASA is doing.

At least NPR reached out to you instead of Australia!

Have a nice weekend,

Kelly

Dr. Kelly Elizabeth Fast

[Near-Earth Object Observations Program Manager](#)
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>

Date: Friday, July 26, 2019 at 8:55 PM

To: Lindley Johnson <lindley.johnson@nasa.gov>, Kelly Fast <kelly.e.fast@nasa.gov>

Cc: 16 16

Subject: Unhappy about Washington Post story

Lindley and Kelly,

As you probably already know, this article in the Washington Post is getting major coverage:
https://www.washingtonpost.com/nation/2019/07/26/it-snuck-up-us-city-killer-asteroid-just-missed-earth-scientists-almost-didnt-detect-it-time/?utm_term=.2a6a298e3707

I find it disheartening that the scientists quoted therein have very little do to with asteroids, and yet the article makes them out as playing a major role in the story and seems to focus on how they felt and what they think needs to be done. They do provide lip service to "NASA" and provide links, but very few will follow those. Why on Earth wouldn't the reporter seek out comments from true experts like you guys at PDCO or observers at e.g. ATLAS, or maybe us at CNEOS whose web site the scientist clearly used?

OK, I'm just venting to you guys, but it is frustrating. Somehow NASA is not seen as the automatic go-to source for questions in stories like this.

By the way NPR contacted me, and I spoke with them this morning. I'll be interviewed on Monday, but interest in this story will be negligible by then.

Have a great weekend!

Paul

Dr. Paul W. Chodas
Manager, Center for Near Earth Object Studies
Jet Propulsion Laboratory
301-121
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-7795 Office
[REDACTED] Cell

From: Hautalauma, Grey (HQ-NI000)
To: Johnson, Lindley (HQ-DG000)
Subject: RE: FW: Good Morning America
Date: Sunday, July 28, 2019 3:10:58 PM

Yes, I think JPL is trying to reach him as well.

From: Johnson, Lindley (HQ-DG000)
Sent: Sunday, July 28, 2019 3:10 PM
To: Hautalauma, Grey (HQ-NI000) <grey.hautalauma-1@nasa.gov>
Subject: RE: FW: Good Morning America

If so, Paul Chodas in CNEOS at JPL should do it.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Hautalauma, Grey (HQ-NI000)" <grey.hautalauma-1@nasa.gov>
Date: Sun, July 28, 2019 3:08 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Subject: RE: FW: Good Morning America

That may be too late, but we'll let you know if there is an opportunity. Thanks.

From: Johnson, Lindley (HQ-DG000)
Sent: Sunday, July 28, 2019 2:32 PM
To: Hautalauma, Grey (HQ-NI000) <grey.hautalauma-1@nasa.gov>
Subject: Re: FW: Good Morning America

Ha! I just boarded a flight to Houston for meetings this week. If things could be arranged through JSC, I'd be willing to do it from there.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Hautalauma, Grey (HQ-NI000)" <grey.hautalauma-1@nasa.gov>
Date: Sun, July 28, 2019 2:09 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
CC: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>

From: [Fast, Kelly E. \(HQ-DG000\)](#)
To: [Moore, Lajuan \(HQ-DG000\)\[InuTeq, LLC\]](#)
Cc: [Johnson, Lindley \(HQ-DG000\)](#)
Subject: Re: Friendly Reminder/It's Weekly Time - Weekly Reports/News Due Today
Date: Thursday, July 25, 2019 4:59:06 PM
Attachments: [2019-07-25-PDCO Weekly.docx](#)

Hi LaJuan,

Apologies for being late! A lot came up this week for the Weekly from PDCO (attached).

Thanks!

Kelly

Dr. Kelly Elizabeth Fast
Near-Earth Object Observations Program Manager
[Planetary Defense Coordination Office](#)
Planetary Science Division
NASA Headquarters
(202) 358-0768

From: "Moore, Lajuan (HQ-DG000)[InuTeq, LLC]" <lajuan.moore@nasa.gov>
Date: Thursday, July 25, 2019 at 2:12 PM
To: HQ-DL-PSD-Staff-
Subject: Friendly Reminder/It's Weekly Time - Weekly Reports/News Due Today

Good afternoon PSD,

Happy Thursday! Please forward your weekly to me by **4:00 PM EST – Today, July 25th**, if you have not submitted it yet. Please remember to flag and/or highlight any item that you think is important and would like to have included in the SMD report. **Please review your weekly to make sure you are using the correct format.** See below:

Weekly Format

This Week's Accomplishments:

-
-

Next Week's Plans/Activities/Events

-
-

Risks/Concerns/Issues

-
-

Upcoming Activities/Events (next few months)

-
-

Please use bullets and limit your inputs to the highlights for areas of work under your responsibility that need visibility at the Division or SMD level. Avoid repeating reports from previous weeks. Aim to keep your input to half a page per person. If you don't have anything for a particular section, that's okay. The purpose of this report is to help us prepare for the weekly reporting to SMD and to know what to focus on during the week. Hopefully, this will reduce the amount of work it's been taking to produce this report for many of you.

Thank you & have a super duper day!

Lajuan Moore

Project Support Specialist
NASA Headquarters
Planetary Science Division
(202) 358-0970

Subject: FW: Good Morning America

Dr. Johnson,

I wasn't sure if you are available or interested in doing this short turnaround hit for ABC to be broadcast tomorrow on Good Morning, America. But please let us know if you are, and we can coordinate the logistics. I believe ABC studios are downtown across from the Mayflower hotel. Thanks for your consideration of this last minute opportunity.

-----Original Message-----

From: Agle, David C (US 1821) [mailto:david.c.agle@jpl.nasa.gov]
Sent: Sunday, July 28, 2019 12:46 PM
To: Hautaluoma, Grey (HQ-NI000) <grey.hautaluoma-1@nasa.gov>; Johnson, Alana R. (HQ-NG000)[InuTeq, LLC] <alana.r.johnson@nasa.gov>
Cc: Segal, Matthew J (JPL-1821)[Jet Propulsion Laboratory] <matthew.j.segal@jpl.nasa.gov>
Subject: Good Morning America

ABC wants an interview today (re 2019 OK asteroid flyby) for a Good Morning America hit tomorrow. Can come out to location - or do interview at with Washington (or LA) bureau. Does HQ want to support - or do you want me to see if CNEOS can support?
DC

Sent from my iPhone

From: Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]
To: Johnson, Lindley (HQ-DG000); Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]; Fast, Kelly E. (HQ-DG000)
Cc: EXTERNAL-[REDACTED] <[REDACTED]> [REDACTED] HO-DG000)[NATIONAL INSTITUTE OF AEROSPACE]
Subject: Re: Unhappy about Washington Post story
Date: Monday, July 29, 2019 2:35:54 AM

Thanks, Alana., these are appropriate responses.

Just to be clear, since the subject line is mne, I wasn't unhappy that there was a story about 2019 OK, or even about the facts quoted in the story, I was just disappointed that a paper like the WashPost didn't even bother to contact the primary sources available right at NASA HQ in DC, or contact us here at JPL/CNEOS, either of whom could have provided background and context on a fairly rare and important event like this one.

By my very quick calculation, and event like this (an asteroid this size passing this close to Earth) happens about once every 70-80 years or so. An actual impact from an asteroid of this size is of course even rarer: something like once every 5000 years or so.

Best,
Paul

Dr. Paul W. Chodas
Manager, Center for Near Earth Object Studies
Jet Propulsion Laboratory
301-121
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-7795 Office
[REDACTED] Cell

From: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Date: Sunday, July 28, 2019 at 7:02 PM
To: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>, "EXTERNAL-Fast, Kelly (US 9300-NASA)" <Kelly.E.Fast@nasa.gov>, "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Cc: "EXTERNAL-[REDACTED]" <[REDACTED]> [REDACTED] <[REDACTED]>, [REDACTED]
<[REDACTED]>
Subject: Re: Unhappy about Washington Post story

That'd be great. Thanks, Alana!

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Johnson, Alana R. (HQ-NG000)[InuTeq, LLC]" <alana.r.johnson@nasa.gov>
Date: Sun, July 28, 2019 8:53 PM -0500
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>, "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]" <paul.w.chodas@jpl.nasa.gov>
CC: "EXTERNAL-[REDACTED]" <[REDACTED]>, "CNEOS" <[REDACTED]>
Subject: Re: Unhappy about Washington Post story

Good evening.

The article is shoddy, especially with NASA HQ right here in DC. That said, at least comments by Emily Lakdawalla at Planetary Society offered some balance.

I have nothing in my email by way of a request from this writer. I will contact her tomorrow and try to familiarize her with PDCO and CNEOS. This is an opportunity to educate her, and WaPo readers, about our efforts, and maybe go for a larger story in the WashPost.

Vr,
Alana

Alana R. Johnson
Senior Communications Specialist
Planetary Science Division
National Aeronautics and Space Administration
Headquarters Washington, D.C.
alana.r.johnson@nasa.gov
Cell: [REDACTED]

On: 26 July 2019 22:48, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov> wrote:

As Kelly says, I think this is lazy journalism.

I dont recognize the name of the reporter. Not one of the usual WP science reporters.

I've copied Alana. Maybe NASA OCOMMS can suggest to WP "WTF, over".

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Fri, July 26, 2019 9:11 PM -0400
To: "Chodas, Paul W (JPL-4085)[Jet Propulsion Laboratory]"
<paul.w.chodas@jpl.nasa.gov>, "Johnson, Lindley (HQ-DG000)"
<lindley.johnson@nasa.gov>
CC: "EXTERNAL-[b6]" >, [b6]
(HQ-DG000)[NATIONAL INSTITUTE OF AEROSPACE]" [b6]
Subject: Re: Unhappy about Washington Post story

Hi Paul,

I hadn't seen this one, but I saw these names in earlier articles elsewhere, so I think it's just the usual lazy journalism where reporters report on and follow up other reporter's reports. That's why the Washington Post is focusing on Australian scientists... they saw them in another article and didn't think about the fact that they're in Washington DC, and that NASA HQ is in Washington DC, hmmm....

Adding [b6] here because she's great at being a third party and reminding reporters that it IS possible to reach directly out to NASA if they want the right information on what NASA is doing.

At least NPR reached out to you instead of Australia!

Have a nice weekend,
Kelly

Dr. Kelly Elizabeth Fast
[Near-Earth Object Observations](#) Program Manager
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(202) 358-0768

From: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>

Date: Friday, July 26, 2019 at 8:55 PM

To: Lindley Johnson <lindley.johnson@nasa.gov>, Kelly Fast <kelly.e.fast@nasa.gov>

Cc:  < >

Subject: Unhappy about Washington Post story

Lindley and Kelly,

As you probably already know, this article in the Washington Post is getting major coverage:

https://www.washingtonpost.com/nation/2019/07/26/it-snuck-up-us-city-killer-asteroid-just-missed-earth-scientists-almost-didnt-detect-it-time/?utm_term=.2a6a298e3707

I find it disheartening that the scientists quoted therein have very little do to with asteroids, and yet the article makes them out as playing a major role in the story and seems to focus on how they felt and what they think needs to be done. They do provide lip service to "NASA" and provide links, but very few will follow those. Why on Earth wouldn't the reporter seek out comments from true experts like you guys at PDCO or observers at e.g. ATLAS, or maybe us at CNEOS whose web site the scientist clearly used?

OK, I'm just venting to you guys, but it is frustrating. Somehow NASA is not seen as the automatic go-to source for questions in stories like this.

By the way NPR contacted me, and I spoke with them this morning. I'll be interviewed on Monday, but interest in this story will be negligible by then.

Have a great weekend!

Paul

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 Cell

From: [Johnson, Lindley \(HQ-DG000\)](#)
To: [Chodas, Paul W \(JPL-4085\) \[Jet Propulsion Laboratory\]](#)
Subject: Re: Why did our surveys not discover 2019 OK
Date: Friday, July 26, 2019 2:28:42 PM

OK, sounds fine.

Just the facts as we know them.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Date: Fri, July 26, 2019 2:22 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Subject: Re: Why did our surveys not discover 2019 OK

DC gave me the OK (!), so I'll call them now. They're on a short fuse...

Paul

From: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Date: Friday, July 26, 2019 at 11:20 AM
To: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Subject: Re: Why did our surveys not discover 2019 OK

They have requested an interview which I have forwarded to OCOMMS for response but have not gotten the Ok yet.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Date: Fri, July 26, 2019 2:09 PM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Subject: Re: Why did our surveys not discover 2019 OK

Thanks for forwarding this, Lindley. This is an interesting question, and we should view it as a learning opportunity.

But I think it is fair to say that 2019 OK snuck past our usual observation checkpoints that catch most such incoming NEAs.

NPR's All Things Considered inquired about this asteroid. Shall I respond? Have you already talked to them?

Paul

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From: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
Date: Friday, July 26, 2019 at 10:59 AM
To: "Chodas, Paul W (US 4085)" <paul.w.chodas@jpl.nasa.gov>
Subject: Fwd: Why did our surveys not discover 2019 OK

Been having the same conversation back here.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: [REDACTED] >
Date: Fri, July 26, 2019 8:19 AM -0400
To: "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>
CC: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>, [REDACTED] <[REDACTED]>
Subject: Re: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

Hi Lindley, all... I will DEFINITELY endorse that there is too much attention paid (blown??) on small objects. There is an infinite loop here and it is a hard one to deal with. We have to keep an eye on possible small impactors, but the only small objects we see are close, so we have to track most of

them.

That being said, I am pretty sure [REDACTED] (who I think can solve all celestial mechanics problems in a single bound) could come up with an algorithm that tells you what the chances are your object of (insert size) could impact the Earth on this apparition. I suspect we could literally clear the NEOCP every five minutes of most of the chaff this way. Maybe we do something like--what's the moid, what's the size of the object, what's the chance of impacting this time around? We could clear out the non-PHAs very easily, and focus only on the objects that need immediate follow-up, and those with small moids but are large enough to be of interest. We would need to guide the surveys a bit on where to survey for the largest and most interesting objects. I think that means repeated coverage of opposition at least for groundbased optical.

I've turned this question inside out and it kinda flummoxes the survey folks--how many 50 meter objects do you have to follow-up before you find an actual impactor? I think it is hundreds of thousands. So this means that if you see a 50-meter object with no chance of impact this time around you should drop it immediately because you're actually damaging your ability to detect the important one. That's probably a little cheeky and cheating with statistics... but some of it rings true.

[REDACTED]

On Fri, Jul 26, 2019 at 8:09 AM Johnson, Lindley (HQ-DG000) <lindley.johnson@nasa.gov> wrote:

Not really instinct. I just looked at the obs submitted on the MPEC.

But what im really wondering is that in an effort to build up their discovery counts, i.e. go for smaller and therefore usually faster moving objects, the surveys are leaving open a corner of the larger objects, albeit while still faint and slow moving.

Lindley

Lindley N Johnson
Planetary Defense Officer
HQ NASA

----- Original Message -----

From: "Fast, Kelly E. (HQ-DG000)" <kelly.e.fast@nasa.gov>
Date: Fri, July 26, 2019 7:54 AM -0400
To: [REDACTED] [REDACTED] >, "Johnson, Lindley (HQ-DG000)" <lindley.johnson@nasa.gov>, [REDACTED] <[\[REDACTED\]](mailto:[REDACTED])>
Subject: Re: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

Wow, not the answer I what I was expecting, but I don't have Lindley's instincts! Thanks so much, Tim, this is really fascinating. And a tough issue since I'm guessing it must be difficult to go after slow objects and not pick up more false detections and to also disentangle them from TNOs.

Dr. Kelly Elizabeth Fast
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(202) 358-0768

From: [REDACTED] >
Date: Thursday, July 25, 2019 at 9:13 PM
To: Lindley Johnson <lindley.johnson@nasa.gov>, Kelly Fast <kelly.e.fast@nasa.gov>, [REDACTED]
[REDACTED] <[REDACTED]>
Subject: [EXTERNAL] Pan-STARRS comments: Lindley wins the prize

Hi all, I got comments back from [REDACTED]. Pan-Starrs missed 2019 OK because it was too faint in June, and too slow in July. It was actually in the clear in the frames in each month (all 4 frames) so it theoretically could have been detected.

I must compliment Lindley on his instincts here. There is a spectacularly important lesson here-- ATLAS and to a lesser extent Pan-STARRS need to detect slower objects. The raison d'etre for ATLAS is detecting imminent impactors. It looks like some impactors are too slow to be found easily. It is fairly disturbing to me that this object was undetectably slow for nearly 2 weeks! Fascinating stuff.

So the executive summary: the object was missed because it was too faint in June, and too slow to detect in July until right before the close approach.

Hope this helps--if you need anything else let me know!

[REDACTED]